THE IRON TRADE REVIEW

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THE IRON TRADE REVIEW.

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CLEVELAND, O., OCTOBER 10, 1889.

THE WEEK IN IRON CIRCLES.

General Features. The inquiry for nearly every kind of iron has become quite large, and additional strength can safely be said to have been added to the already strong market. Our Detroit correspondents, Messrs. Wm. F. Jarvis & Co., say that Lake Superior charcoal has been sought for in small lots of one and two hundred tons, but no large orders are visible. These smaller lots have brought full market figures in every case. Some furnaces have absolutely withdrawn from the market, being unable to furnish for immediate orders, and thinking the demand warrants them in declining to make quotations for delivery during any portion of the next year. The excessive demand for grey forge iron has raised the price of this grade up out of proportion with better foundry grades, and nearly as much is obtained for it as for straight foundry No. 2 (Northern grading) in some cases. Bessemer is very strong, and judging by the demand in the West and South during the past week for steel rails, will go considerably higher. Quite a demand has existed for Ohio softeners at full rates. Old rails and old wheels are hard to obtain at quoted figures. A strong, even demand continues at Cincinnati for all iron products. Unquestionably the demand is in excess of the production for the time being. How far purchases are made beyond actual requirements because of an advancing tendency of the market is a question that is impossible to accurately decide. Some veteran observers think that foundries and mills are over-buying for this reason, and there will be a decided slacking of demand later. On the other hand traveling men, who are visiting consumers constantly, state that the orders placed for crude iron are hardly more than keeping pace with the increased demand for finished products. Grey forge sold at the close of the week at $14.50 cash, Cincinnati. Foundry grades have not moved up quite in proportion, but will average 25 cents higher than a week ago. The greatly improved railroad situation, and the increased call for steel rails and rolling stock, make a strong foundation for the market. No large sales are reported in Chicago, but every day sees a liberal batch of small orders booked. There is more or less talk about scarcity of iron, but no buyer yet has failed to supply his wants at the current market rates. Prices continue to advance slowly, and concessions that were common a few weeks ago, are not thought of longer. Chicago being the battle-ground for so many competing districts, local buyers have come to regard as rights certain concessions in terms and privileges that are counted as exceptions in other markets. A time like this gives the furnaces an opportunity to trade more on their own terms. It is thought by well posted authorities that Lake Superior charcoal iron must soon see $20 at Chicago. As predicted last week there is greater activity in the Buffalo iron market. Several local sales have been made during the past few days and inquiries are very numerous. Most of the furnaces have large amounts of iron on their books for future deliveries, and are not disposed to sell on the present market for deliveries beyond January 1st. Mill irons are very scarce. A general advance on all grades will probably occur early next week. The encouraging features that have been noted for several weeks past are still prominent in Louisville, and prices have been moved up on all grades, and it is difficult to get a supply of Southern irons to meet the requirements of trade. The tone of the market at St. Louis is firm with a fair amount of business. An inquiry for white and mottled irons has shown that there is no stock of either grade in the South. Some of the furnaces who have nothing to sell have advanced quotations much above the market, while others who have special lots to dispose of are accepting the lowest figures. The market at Pittsburgh continues strong, with an upward tendency. A further advance of twenty-five cents per ton was established last week, considerable mill iron having been placed at $16.25, and some parties are now holding for $16.50. Bessemer iron is especially scarce and strong. Messrs. S. W. Royse & Co., our Manchester (Eng.) correspondents, report that a strong demand for iron continues both for present and forward delivery, but consumers, whilst willing to pay a small advance, hesitate before yielding to the prices asked. This hesitation may cause them to pay still higher rates.

Iron Ore. Anybody who has any kind of good ore for sale may dispose of it quickly at this time, and at an advance of of from 25 cents to half a dollar over the prices that governed the market during the selling season. Strange as it may seem, the extraordinarily large production of '89, although exceeding that of '88 by twenty-five per cent., has failed to satisfy the demand, and the explanation is found in the anticipation, by furnace-men, of increased prices in 1890, so that the larger and wealthier concerns are, and for some time have been loading up with ore to protect themselves. Several large ore dealers have been approached for quotations for '90 ore, but it has been deemed inadvisable to anticipate the reason at such an early day, and nothing will be done in this direction until the close of navigation, when the mines will be in a condition to enable an approximate estimate to be made of next year's output. The season, thus far, has been very satisfactory in every sense, and while prices have not been high, they have yielded a fair profit. Freights are somewhat stronger, Escanaba charters commanding $1.10, Marquette $1.30, and Ashland about $1.40. Coke is sold at $1.50 at the ovens, an advance of another twenty-five cents being looked for on November 1.

Pig Iron. There is not a furnace in the Central West that is in condition to produce iron, but is in blast, working day and night in a vain effort to keep pace with the enormous demand. It is next to impossible to quote correct prices, from the fact that the great consumption of the pig material gives to the furnace-man the opportunity to make his own price, differing in each case with the necessities of the consumer, and the pressure of his wants. Bessemer iron was sold at $19.50, cash at the furnace, during the beginning of the week, and the chances are that it will reach $20 before the week is out. Foundry iron, as well as all grades of mill material, are in in active demand at advanced prices, and no one seems to know exactly how much to ask. Conservative furnace-men content themselves with disposing rapidly of their stocks as fast as manufactured, declining to contract for long delivery whenever possible, and asking a large bonus when entered into. How long this unexpected demand will continue, or what has brought about such an improvement, is difficult to explain; but the fact remains that iron is high, and the prospects favor still further advances.

Merchant Iron. There is a strange disparity in the prices obtained for bar iron, for while one firm claims to have bought at $1.65, another has sold at $1.75, and the price is whatever can be got, a free-for-all. The demand is good in all the lines, sheets being very high, and combination makes selling fully up to the fixed price.

Scrap Iron. Old American ralls, although quoted at $27@$28 in Pittsburgh, are offered at $26.25 in this market and at that figure are selling freely. There is quite a buying movement in choice railway scrap. Wheels are rather quiet, and axles sell up to $28.

Hardware. Wholesalers report a very good beginning in their Fall trade, no one specialty, however, predominating. Cut nails are on the advance, and within the next thirty days are expected to go up fifteen per cent.

CLEVELAND VS. THE CLYDE.

It is an extremely interesting and practical report which Mr. Frederick D. Wheeler, of Bay City, Mich., submits, as the shipbuilding expert in the Scripps League expedition to Paris. It will surprise not a few to learn that the steel vessels built on the Clyde for salt-water service are not of so strong build as those built in Cleveland ship-yards for service on the lakes; yet such is the fact. Mr. Wheeler compares the Harlem, built for lake service, with an A1 (Lloyds) vessel built in Scotland, and from his figures we evolve the following table:

	American Vessel.	Scotch Vessel.
Length over all	300 feet.	290 feet.
Beam	41 "	39 "
Depth	27 "	28 "
Main frame	4½x3½	4x3
Reverse bar	3½x3½	3x3
Bottom tank	260 ft.	220 ft.
Average thickness of steel plates	⅝ in.	½ in.
Bulk-heads	5	3
Weight	1,450 tons.	1,200 tons.
Contract price	$275 000	$150,000

Equally interesting is Mr. Wheeler's contrast between the wages of ship-builders on the lakes and on the Clyde. He groups them as follows:

	On the Clyde.	American Yards.
Number of hours	9½	10
Ship carpenters	15½c.	30c. per hour.
Ship joiners	14c.	25c. " "
Riveters, ⅝ to ⅞, (per 100)	20c.	30c.
Platers	$1.62	$2.00 per day.
Platers' helpers	87c.	1.50 "
Furnace-men	$2.50	3.25 "
Furnace-men's helpers	$1.00	1.50 "
General labor	87c.	1.50 "
Blacksmiths	$1.75	2.50 "

To offset the apparent advantage of low wages, American shipbuilders have, Mr. Wheeler asserts, vastly superior machinery; so that the number of employed to do any part of the work is much less in this country than abroad.

On the other hand, the Clyde get their steel much more cheaply than do the American builders, in proof of which Mr. Wheeler submits the following table:

	America. Per 100.	Great Britain. Per 100.
Round iron	$1.90	$1.65
Manufactured iron	2.30	1.90
Plate iron	2.10	1.90

Add 12 per cent. to get the cost of steel.

As to the social condition of the ship-carpenters here and abroad, Mr. Wheeler says: "They (the foreign employes) live shabbily, and in many cases they are satisfied to call a loaf of bread and a glass of red wood wine a meal. In America, our ship workers live in their own homes, and their tables have an abundance for a good meal. They not only enjoy the comforts of life, but many of them enjoy its luxuries also."

Mr. Wheeler's conclusions as to the future of the American shipbuilding industry are valuable as coming from a man of wide observation and experience, and with this portion of his report we close this article. He says: "My general conclusion from what I saw abroad was, that while the foreign ship-building industry, such as that of the Clyde, was far more extensive than ours, yet that it would have to give way eventually to American manufactures of this class. They cannot compete much longer with our American machinery and American methods; and I predict that within 15 years America will have a good share of the ship-building now done on the Clyde, and with that start it will not be long before America will build her own ships."

FUEL GAS FOR MANUFACTURING PURPOSES.

Whatever the advances made, within the past five years, in the production of cheap fuel gas,—and they have been highly creditable—perfection has by no means been reached, nor is the displacement of coal, apparently, a thing of the very near future. Few manufacturers, in their desire for the advent of the new fuel, have appreciated the fact that fuel gas at the seemingly low figure of, say, fifteen cents per thousand, really falls short—considerations of convenience and cleanliness aside—of proving a competitor of coal at $2.50 per ton. Profesor S. A. Ford, of the Edgar Thomson Steel Works, Pittsburg, in a recent report, figures out the heating power of 1,000 feet of natural gas, making due allowance for the advantages of application, as compared with coal, is equal to 81.61 pounds of bituminous coal; or, in other words, it takes 24,500 cubic feet of natural gas to equal one ton of 2,000 pounds of good coal; or, speaking in round numbers, 25,000 feet of gas is equivalent to one ton of coal; or, if we reckon 2,240 pounds to a ton, it takes 27,440 cubic feet of natural gas to equal one ton of coal.

If this be correct, then, as clearly shown by Mr. W. S. Collins, in the *Bulletin* of the American Iron and Steel Association, 25,000 cubic feet of fuel gas, at fifteen cents per thousand, would be equivalent to one ton of coal at $3.75, which would not be economy at all in this region. In order to be of any economic value in districts like this, where the best of coal is so cheaply supplied, fuel gas must be furnished at a figure below ten cents per thousand feet. The nearest approach to this, to our knowledge, is petroleum fuel gas, which, at four cents per gallon for the crude distillate, can, it is claimed, be supplied at eight cents per thousand feet in the gaseous form. At this figure, 25,000 feet of gas would be equivalent to coal at $2.00 per ton—which is something more like it.

FROM THE NEW YORK METAL EXCHANGE.

The following letter needs no introduction and very little comment:

TO THE EDITOR OF THE IRON TRADE REVIEW:

Will you permit me to say, with all due respect, that your editorial on pig iron speculation is unworthy alike of the ability manifested in your paper and of the enterprising section for which it is published. We make no bones of the fact that the chief object of the Metal Exchange, as of all exchanges, is to systematize and, so far as possible, to foster speculation, and we recognize this fact with the firm conviction that such speculation as takes place on exchanges is an important part of the machinery of modern trade, facilitating the cheap and quick transfer of goods or securities, reducing the violence and extent of fluctuations in price and diminishing the risk of such fluctuations as do occur. The data on which this opinion is based have been so often set forth that it would be tedious to reiterate them, the more so as they are illustrated in the history of every commodity which has been successfully placed upon an exchange. You not only ignore all this, but apparently assume that exchanges create speculation as well as stimulate it. Does your memory not go so far back as 1879-80, when there were no exchanges on which iron could be dealt in? You have deprecated the possibility of a "boom" setting in now. Do you think there is any power, even in downright socialism, that can prevent it, with or without the system of an exchange, if the favorable conditions continue to develop themselves? When you have answered that I would like your opinion as to whether the speculation incident to such a boom had not better be conducted under known rules, hedged around by such safeguards as the proper deposit of margins, and so broadened that the bringing quickly together men with diverse views as to the probable future of prices, will diminish the suddenness and extremes to which prices will run, either up or down. Yours truly,

E. L. SHRIVER,
Secretary New York Metal Exchange.

NEW YORK, Oct. 5, 1889.

Mr. Shriver very cleverly presents the best side of what may, perhaps, be denominated a necessary evil. To take issue with him on the merits of speculation *per se* would be a useless and tiresome task. Concerning the wisdom of dragging a standard commodity, like iron, into the maelstrom of Wall street, there is chance for a wide divergence of opinion. A very considerable portion, we may say, the great conservative portion of iron manufacturers think it is all wrong. The paid secretary of the New York Metal Exchange thinks it is all right. He certainly has a right to his opinion.

AURORA, ILL., GETS THE STOVE WORKS.

All surmises as to the intentions of Messrs. Rathbone, Sard & Company, in the matter of the removal of their Albany plant to some Western point have been set at rest by the announcement that they have decided upon Aurora, Ill., as the location of their new works. Aurora is only 38 miles from Chicago, and the enterprising citizens have donated fifteen acres of land, and $60,000 cash—certainly a sufficient inducement all around to settle the matter beyond a peradventure. While this is spoken of as a removal, it practically amounts to the establishment of a new plant in the West, the Albany concern still continuing in operation, and the transfer of business only taking place as the wisdom of the movement is actually demonstrated. It is not expected that the Albany operatives will be taken along, nor do we understand that the heads of the concern will change their residence. However, they are extremely wide-awake and active business men, and the impress of their indomitable energy will no doubt be equally felt at Aurora and Albany. Cleveland, along with several other expectant cities, will hear this announcement with regret, but now that the decision is made, will wish Messrs. Rathbone, Sard & Company all success in their new venture.

WE understand that work is progressing on the three-mile railway necessary to connect the Cuban iron mines of Messrs. George H. and S. P. Ely with the sea, and that shipments are expected to begin next year. Successive assays of the ore show metallic iron from 68 to 69 per cent. and phosphorus .030.

THE HARDENING AND TEMPERING OF STEEL.

On Friday, September 13, Professor Roberts-Austen, of the Royal Mint, lectured at St. George's Hall, Newcastle-on-Tyne, Eng., on the "Hardening and Tempering of Steel." From our English exchanges we obtain the following interesting abstract:

After a tribute to the memory of the late Dr. Percy, who had almost created an English literature of metallurgy, and a reference to the national value of Lord Armstrong's efforts in developing the use of steel, Professor Roberts-Austen proceeded to give a brief history of our knowledge of the art of hardening and tempering steel. Hardening is the result of rapidly cooling a highly heated mass of steel. "Tempering," or softening, consists in reheating this hardened steel to a temperature far short of that to which it was raised before hardening. He demonstrated these facts by hardening and tempering three sword blades of the same steel, and of excellent quality, showing how greatly the efficiency of the weapons depended on the treatment they received. A sword blade which was over-hard, snapped under gentle pressure into many fragments, while one which was over-tempered could readily be bent by the hands and remained crooked. Professor Austen stated that such facts are of vital importance to the nation, Mr. Ruskin even having said that iron-working is the only art "of any consequence which we have at present in England," and that on armor plates "our courage and endurance are written forever with an iron pen on iron parchment." Notwithstanding the great importance of the art of hardening and tempering, the theory of the process is still far from clear, and such knowledge as we possess has been but slowly gathered. It was shown that in early times great pains were taken to secure what was believed to be a suitable solution for quenching the hot steel so as abstract its heat. Othello's sword, Shakespeare said, had the "ice brooks temper," but cold water was far too simple a material for many a 16th century artificer to employ, as is shown by the quaint receipts for hardening steel which have been handed down to us; the operator being directed in a manual, published in 1531, to "take snayles and boil them with rain water, taken in the two first months of harvest," in which solution, if hot steel were plunged it would be very hard, the craftsman being prettily told, so late as 1809, that he might "take the root of blue lilies, infuse it in wine, and quench the steel in it, and the steel will be very hard." The belief in such quaint "nostrums" survived into the present century, and it was pointed out that the early workers were right in attaching great importance to the nature of the fluid in which the steel was quenched, though their theories were wrong, the degree of rapidity with which heat is abstracted from the cooling steel being as important at the present day as it ever was.

Professor Austen then traced the history of the theories relative to the internal constitution of steel, pointing out that the work of Bergmann, of Upsala, showed, in 1871, that steel only differs from iron by containing two-tenths to one and one-half per cent. of carbon. The curious relation between the belief in the existence of Phlogiston, and the fight made by the Phlogistic school with that of Lavosier over the constitution of steel, was dealt with at some length, and it was pointed out that the work of Bergmann, though himself a believer in Phlogiston, had entirely changed the situation by showing that carbon was the steel-giving element. Clouet did much to prove (1798) that carbon in its diamond form could combine with iron and convert it into steel, a fact which had been confirmed by a working cutler, Mr. H. Pepys, in 1818, and finally by Professor Austen himself, who, for the purpose of the lecture, had heated diamond and carbon together *in vacuo*, because in all previous experiments a doubt as to the action of the gases contained in the iron had existed. Professor Austen then proceeded to consider the mode of existence of the carbon in the steel. He showed at great length that although carbon in any of its forms, graphite, soot or diamond, could enter into intimate association with iron, the relations of carbon and iron were really very complex. The researches of Karsten, Berthier, and, finally, of Sir F. Abel, had shown that in soft steel the carbon exists in the form of a true compound or "carbide" with iron, while in steel which has been hardened by rapid cooling the carbon is "dissolved" and not truly combined, in "tempering" or softening steel another change in the relations of the carbon and iron being effected, the degree of hardness of the steel depending mainly on the relation subsisting between the carbon and the iron, although the state of the carbon did not explain all the facts of hardening and tempering.

The next portion of the subject was one of great difficulty. Professor Austen gave full reasons for the belief that iron itself can exist in more than one state. For instance, carbon may be equally pure carbon either in the diamond or sooty form; sulphur is equally a pure sulphur either in a form which is soft and pliable at ordinary temperatures, or in the hard, yellow form with which we are all familiar with it; the soft passing instantaneously into the hard varieties with evolutions of heat. In the same way there is strong reason to believe that at a red heat the molecules of iron are really hard. If pure iron be cooled, either quickly or slowly, it passes into the soft modification, but, if carbon be present and the metal quickly cooled, it has no time to pass to the soft modification, the presence of the carbon hinders its passage, and hard steel is the result. Bearing in mind that evolution or absorption of heat is the surest indication of molecular change in the element, Professor Austen gave experimental evidence of the evidence of the existence of molecular change in iron. Ohe experiment which he did was very curious. A red-hot bar was taken from the furnace, gripped only at one end, while a weight was attached to the other. The bar did not bend when being in its hottest state; it might have been expected to be soft, but it fell six inches as soon as the point of molecular weakness came, the iron being comparatively cold. Professor Austen showed how important the action of small quanties of matter on masses of metal really is, pointing out that this appeared to be a broad principle of nature, one recognized by the alchemists, and still employed by metallurgists, who marvel daily at the extraordinary effect which would be produced on iron by quite small doses of sulphur, phosporus, chromium or aluminum. Professor Austen said he was not afraid of the taunt of Francis Bacon that "sottishly do the chymics appropriate the fancies of poets in the transformation of bodies to the experiments of their furnaces," for, although metals could not be transmuted, they could be transformed by very slight influences, so as to behave, from the point of view of special work demanded from them, either beneficially, or prejudicially. He concluded by pointing to the importance of hardening and tempering in relation to all kinds of steel. In the early days when steel was substituted for iron, it was viewed with suspicion, mainly because the fact that iron could exist in two distinct molecular states was ignored. He showed that the material of which the Forth Bridge is made owes its substantiality to the fact, while being very strong, it is very soft and ductile and will not harden energetically.

The enormous importance of the substitution of steel for iron was shown by figures supplied by Mr. Webb, of Crewe, who stated that on the entire system of the London & Northwestern Railway 18 tons of steel disappeared daily by oxidation and wear. The importance of oil hardening in relation to gun steel was shown by the fact that at the St. Chamond works on the Loire they had a tank containing 44,000 gallons of oil, into which the hot gun steel was plunged. With regard to highly carbonized steels, it was shown that a properly tempered die would strike 40,000 coins, while one which had been over-hardened would probably fracture with the first coin it attempted to strike. In conclusion Professor Austen said it was strange that so few researches had been devoted to the relations of carbon and iron, and so many to organic chemistry. This arose, he thought, from the belief of chemists and physicists that operations which involved the use of high temperatures were necessarily inaccurate. It could not be that the chemists feared, to quote Macaulay, that "science would be degraded by being applied to any purpose of vulgar utility," for he trusted that he had shown that "the empire over matter," which is the object of all research, could be as surely gained in the field of metallurgy as in any other.

Pitting of Iron.

Many persons have expended much time and experiments in trying to account for the destruction of iron by pitting. As yet we have never seen any solution of the cause. Our view is that this trouble is caused by the dissolving out, or the exposure of certain impurities in the sheet, which have worked in during the process of rolling the sheets—be the same slag, cinder, silica, or what not. Pitting is supposed to be confined to boiler iron or steel exposed to steam pressure, but observation will show that this is a mistake. Anyone who has put away stove-pipe or a stove with a sheet iron jacket, has found, in a dry place like a garret, for example, or can find, that the pipe has "rotted" or pitted in spots, exactly as boiler flues do. In the case of boiler the results are more rapid than in the stove, because heat, pressure and moisture aid in the destruction. Our view of this matter, that the pitting is inseparable from the metal, and not due to boilers and boiler pressure only, is corroborated by the fact that even polished metal, steel or iron, is subject to the same trouble. Razors or knives of all kinds have pin-spots of rust upon them, which extend some distance below the surface when they are laid away and out of use. It is possible to arrest this pitting, when taken in time, by clearing out all the rust, dirt, or whatever it may be, stopping the pits with graphite—that is, blacklead—or hydraulic cement, made thin and laid on with a stiff brush. We do not think it is possible to prevent pitting from taking place in iron surfaces.—[The Engineer.

Gas Coal Along the Clinch Valley, Va.

The results of experiments made with samples of gas coal recently sent to New York, taken from veins tributary to the Clinch Valley division of the Norfolk & Western railroad, in Southwestern Virginia, establishes the fact that they will command a share of the patronage now enjoyed by the Pennsylvania, Westmoreland and Youghiogheny coals in all the Eastern markets. They are equal in value to the best coals from the districts named, and and are thought by experts to be superior to the gas coals mined on the Chesapeake & Ohio and Baltimore & Ohio roads. The veins are from five to six feet thick and very easily mined. The owners of these properties are prepared to make leases for coal operations on reasonable royalty. The greater portion of the gas coal field is controlled by the Tazewell Coal & Iron Co., with headquarters at Tazewell Courthouse, Va., and T. P. Trigg and associates, Abingdon, Va. The demand for this class of coal is increasing yearly, and it is expected that the shipments to eastern cities from the line of the Clinch Valley division during the year will be very large.—[Roanoke (Va.) Times, September 24.

Death of Capt. W. R. Jones.

Capt. W. R. Jones, general manager of the Edgar Thomson Steel Works, died in Pittsburgh, Saturday night, September 28, at the Homœopathic Hospital of injuries received in the recent terrible accident at that plant. His death was a surprise, as he was believed to be in no immediate danger. Capt. Jones had a world-wide reputation in iron and steel circles, and was universally esteemed by all who knew him. His salary and share of the profits from the production of the extensive plant exceeded, it is said, $50,000 a year. The deceased was 50 years of age, and leaves a wife and family.

GRAND RAPIDS and Holland (Mich.) business men are proposing to run a canal from the former city to Holland and Lake Michigan at a probable cost of $2,000,000. The Holland route is the shortest and easiest for Grand Rapids to connect with Lake Michigan. A committee composed of members of the Board of Trade and other citizens of Grand Rapids and Holland will investigate the route.

AN electro fire engine is a new invention. It can be started at full speed and is much lighter than the steam fire engine.

WELDING BY ELECTRICITY.

The subject of welding by electricity has for some time past engaged the attention of American electricians, with varying but generally satisfactory results. Now the subject is being taken up in Great Britain, as we see by our foreigh exchanges.

At the recent meeting of the British Iron and Steel Institute, Mr. W. C. Fish, of Boston, Mass., read a paper on "The Thornson Electric Welding Process," from which we take the following: The requisites of an electric welding plant, generally speaking, are:

1. Apparatus for the production of a suitable current, with means for quickly and exactly regulating the current. The current for welding may be either continuous or alternating in direction. The employment of the alternating current offers certain electrical advantages in the production of a sufficient current strength and in the transmission of energy to a distance from the source of supply, and is that usually employed.

2. Clamps which shall hold the pieces to be welded in correct relative position, and which shall be relatively movable in such a manner that the pieces may be forced together when heated.

3. A method for permitting the welding current to enter the pieces without loss of energy. This is usually accomplished by causing the movable clamps which hold the pieces to become a portion of the circuit, and, from their ample contact, both with the pieces and the remainder of the circuit, to offer no appreciable resistance to the current flow.

4. A manner of obtaining a suitable pressure which shall force the pieces together during the operation of welding.

The last three considerations relate chiefly to simple mechanical details, and are easily obtained. With our present knowledge relating to the transfer of heat energy into electric energy, a welding current, that is, one of great volume, is best produced by the three following methods:

1. The employment of secondary or storage batteries. This method is scarcely comparable with the two which follow, though it might be used to advantage in certain special cases and particularly where the existing steam plant is of insufficient power. In this case energy could be stored in the batteries and drawn upon when sufficient is accumulated.

2. A dynamo of extremely low armature resistance furnishes current directly to the weld. The weld, however, must be near to the dynamo, else, unless cumbersome and expensive leads be employed, the loss of energy in the conduction of the current would be excessive. In practice, the clamps carrying the pieces to be welded are placed directly above the dynamo on a suitable table. This system is simple and economical, but necessitates the carrying of the "work" to the dynamo.

3. The employment of an alternating current dynamo and a transformer. The function of the transformer is to transform, through the medium of a magnetic circuit, the comparatively high electric pressure and small current produced by the dynamo into a current of comparatively great volume but of low pressure, which current shall be applied to the weld. Since, by this system, we can carry the small current produced by the dynamo to any desired spot with little loss of energy, and through conductors of small cross-sectional area, and there obtain a current of the desired magnitude, this method is the most flexible and useful of the three.

Placing our dynamo near any suitable source of mechanical energy, the welding may be done at a distance of a mile or more, if need be. The circuit of the transformer in which the heavy welding current is produced, usually consists of a single turn of heavy copper bar, terminating in the movable clamps which carry the pieces to be welded. As we have already seen, the electric weld is generally made by the passage of a suitable current through the pieces to be welded, and the consequent production of heat at their point of abutment, combined with the application of pressure, forcing the pieces together. The different fluxes employed in the electric process are similar to those used in the ordinary methods of welding and brazing. The pieces in some cases are slightly rounded at the ends before welding, both to increase the localization of heat, and to ensure the thorough fluxing of the metal, and the expulsion from the weld, upon the application of pressure, of whatever combinations of the flux and metal, and other impurities, may be present.

In addition to the ordinary method of determining the welding heat—namely, the color of the metal—the operator of the welding process is also guided by the resistance to compression which the pieces exert when subjected to pressure. With a well-known grade of steel, for example, one might make the weld with eyes closed, relying entirely for the determination of the welding heat upon the "feeling" of the metal when under pressure.

The pressure applied generally produces at the weld an enlarged cross-sectional area. Through different combinations of heat and pressure, this enlargement is somewhat under the control of the operator, and those metals, such as iron and steel, which are not "hot-short," can be reduced by hammering while the pieces are hot. Judicious hammering at the weld, particularly with the harder grades of cast steel, is often advantageous on account of its refining tendency. The fibre of wrought iron can also be restored by hammering, though, as a rule, the continuity of the fibre is but little impaired through welding.

Some metals, such as copper and brass, weld at a temperature nearly equal to that of fusion, and have also a very limited range of temperature within which the weld can be made. In welding metals of this nature, the tension of a spring may be nicely adjusted to produce the necessary pressure, to give the desired approach of the pieces at exactly the proper temperature, and this done, to automatically shut off the current from the weld.

Another advantageous result of the simultaneous application of pressure and heat, is the slightly greater permissible range of temperature, within which the weld can be made, and the consequent decrease of danger of burning the metal. Thus the welding temperature of certain classes of steel can be slightly reduced below that ascribed to the given metal in the smithy, by the substitution of pressure for temperature. The following figures, taken at random, give a few results of tests made on the tensile strength of welds:

Material.	Breaking Strength per square inch.	Position of Fracture.
	lb.	
Wrought iron	53,110	1.7 inches from weld
Cast steel	81,000	At weld
Bessemer steel	59,584	At weld
Copper (hard drawn)	31,830	At weld
Copper (hard drawn)	32,480	¾ inches from weld
Brass	40,820	At weld
Brass	47,730	¾ inch from weld
Steel and German silver	40,410	At weld
Cast steel and wrought iron	52,130	3 inches from weld in the iron
Brass and wrought iron	33,559	At weld

Generally speaking, in the welding of the ordinary commercial metals, after the characteristics of the metal and the knowledge of the requirements for its welding have been gained by experimenting, a tensile strength, at the weld, of 90 per cent. of the strength of the unwelded metal is obtainable.

The time of welding varies with the conditions under which the weld is made. Thus, but only within limits, a comparatively large expenditure of electric energy for a short time is equivalent, for welding, to a smaller expenditure of energy during a longer time. The quicker a weld is made, however, the more economical it is, since there is less time for the loss of energy through the conduction and radiation of heat. Determinations of the power and time required for welding give somewhat empirical results, owing to the indeterminable effects of conduction and radiation of heat, and other factors more or less changeable with different sizes and metals. For the same reasons, no general statement can be given of the required current density per square inch.

From many tests upon the time and current required for welding iron of varying sizes, mention may be made of the following approximate figures, which are also closely applicable to steel:

Amperes per square inch required.	Time of Weld.	Product.
9,500	40 seconds	380,000
12,000	30 "	360,000
15,000	20 "	300,000

The power required per square inch of material in the last case, for example, the material being round iron of one-half inch in diameter, is the product of 15,000 and 1.16 (the number of units of electrical pressure or volts in the welding circuit), giving 17,400 volt-amperes, the equivalent of 23.2 horse-power. Assuming the efficiency of the electrical apparatus to be 85 per cent., we obtain 27.3 horse-power as that to be applied to the belt of the dynamo. The actual power required for the half-inch bar itself is, if we keep our same imagined efficiency of electrical apparatus, 5.36 horse-power.

It may be of interest to mention the possibility of electric riveting, which has already been accomplished on a small scale, and is found to be a perfectly practical process. The cold rivet is placed in the rivet hole and electrically heated to the proper temperature. The heating of a half-inch rivet, of two or three inches in length, would occupy probably about 20 or 30 seconds. As the plate itself becomes somewhat heated in the immediate vicinity of the rivet hole, there is a partial weld made between the rivet head and the plate.

A New Tin Enterprise in Virginia.

Messrs. Campbell & Henley, of Irish Creek, Va., under recent date, write the *Bulletin* of the American Iron and Steel Association, as follows: Your recent letter, inquiring about the reported erection of a furnace in Rockbridge county, Virginia, for smelting tin ore, was duly received. The report is correct. A small furnace, of the daily capacity of one ton of metallic tin, has been built and we hope to commence smelting opperations in the course of a few days. A mill for crushing the tin ore has also been erected, and is now fully equipped with the neccessary machinery for reducing the ore. The power will be furnished by a 20-foot over-shot water-wheel, and we will use a 6-stamp mill, with an elevator and washer, for crushing the ore. The stack of the furnace is 30 feet high, is 42 inches in diameter, and is lined with fire-brick. The blast was made by the Buffalo Forge Fan Co., and is all under cover.

We have plenty of good tin ore about two miles from our furnace. Thirteen veins of ore have been opened on our property, which consists of about 400 acres. Our works were all planned and built by ourselves. We will send you samples of the tin when smelted, which you can send to the Pittsburgh Industrial Exposition.

A Large Cable Hoisting Machine.

The Trenton Iron Co., of Trenton, N. J., has completed a tramway in the Blackington Farm quarry, of Rockland, Conn., which has one of the longest stretches of cable and is one of the biggest plants of its kind in this country. The cable is 1¾ inches thick, of cast steel with a steel center, and is 1,255 feet long. The weight of the wire on its reel was 10,000 pounds. The anchorage weight, at the power end, is 75 tons, while the weight of the wire, with its pulleys, cars, etc., is 36 tons. The breaking strain of the wire is 110 tons. The cable is passed over towers 42 feet high, and the wire in the sag is 125 feet above the quarry floor. The hoisting apparatus consists of a traveling car, which goes back and forth on the wire, never leaving it, and 19 trolley blocks which support the wire that controls the fall block, which lowers the drag or bucket into the quarry. The apparatus allows the drag or bucket to be lowered and hoisted from any point on the quarry floor the entire length of the wire

Companies in Japan.

The number of companies possessed by Japan at present is 226, controlling a capital of $50,000,000; 114 of these companies have a limited liability. Half of this capital is employed in the construction of railways, steamers and other means of transport. One-third is embarked in industrial undertakings. Only eight companies possess a capital surpassing $1,000,000; of these, two are railway companies, and four are engaged in industrial enterprises.

AMONG THE IRON MINES.

Lake Superior Mining Notes :—

GOGEBIC RANGE.

Joseph L. Colby was in the city Thursday and brought the welcome tidings that the Colby mine will be operated quite actively during the winter months, and next season it will in all probability be brought to its full capacity.—[Pick and Axe.

John R. Berringer returned from Milwaukee Monday. While gone he made arrangements for the beginning of operations on the South Range in a few days. Mr. Berringer represents a company of New York capitalists who own thousands of acres of land along the range and is also owner of a large tract himself. The Rhinelander branch of the Lake Shore road passes through these lands and will greatly faciliate operations there. Mr. Berringer says that a plant of machinery will be taken there and a thorough course of exploration begun. There are indications of large deposits of magnetic Bessemer ore and some valuable discoveries may be made there in the future.—[Ironwood Times.

MARQUETTE RANGE.

Work is still progressing at the Merryweather mine, under the management of Wm. Willis, and the indications are very encouraging for the discovery of a large body of ore, which means a large mine.—[News.

Work is progressing at a satisfactory rate at the Salisbury mine. The new engine house is almost completed. The new shaft, a few feet east of the engine house, is now down 500 feet, and from the appearance of an accumulated stock pile, in close proximity, it is evident that ore is being hoisted daily. —[Record.

MENOMINEE RANGE.

R. D. Perkins, agent of the Mastodon mine, has a promising exploration on the forty north, and adjoining the Mastodon mine. A line of test pits have shown up some pretty fair ore, and there is no reason why the ore does not exist in quantity at that particular spot. The ore found is similar to that taken from the Mastodon mine.—[Current.

Capt. Calhoun has secured an option, from the the Caledonia folks, on the forty immediately south of the old mine, on section 20. The *Mining News* learned yesterday that the captain has three pits all in good, clean ore. The pits are sunk near the bank of the river, and opposite the point where ore was found during low water, early in the Summer.—[Mining News.

The shafts at the Bohemia mine are still in the ledge which is largely iron ore, though as yet not clean enough to be merchantable. Depth seems to enrich the ore, and it is quite probable that before another week the ore will clean up, and enable the Bohemia to make a first-class showing. Capt. Row, late of the Ludington mine, Iron Mountain, has charge of the work, and is conducting the exploration in a very judicious and systematic manner.—[Mining News.

At the Chapin, the ore is still being sent to the surface at a lively rate, and the 50,000 tons of last month will be equaled, if not exceeded, by the output of this month. The present working force is a large one, and while the stoping is giving good results, much work of a preparatory nature is being done. That the Chapin is destined, should its owners see fit to test its capacity, to produce a million tons in one year can hardly be doubted. When the preparations now being made are completed, it will be no trouble to hoist 100,000 tons per month through the four shafts, B, C, D and the new five-compartment timber (?) shaft, and as to its being mined there need be no question. It may not be generally understood that there is a large lens of ore on the Chapin property which has never been wrought, but the future will disclose this fact.—[Current.

The Hemlock River mine will soon be supplied with railroad facilities, if the present indications go for anything. The Hemlock is a great property, and the railroad companies seem to know it; one of the upper peninsula roads will put in the spur at once, for fear the other will get the start. Both the Chicago & Northwestern and the Milwaukee & Northern have their surveying parties running preliminary lines, and it is understood that the Hemlock company has made no contract with either road, but will do the business with the one to first commence active work. If the Chicago & Northwestern put in the track, and the chances are more favorable that it will, the Armenia spur will be started from that mine on to the Hemlock, along the trend of the east range, tapping the Hollister mine, besides being in readiness should other mines be found on the range. Should the road be built as intended, it would have a tendency to greatly stimulate exploring along the range.—[Mining News.

At the West Vulcan the ore has been reached at the eleventh level of the vertical shaft by driving about fifty feet. Enough work has not yet been done to determine the size of the ore body at this point, but the ore now being broken out is a first-class article, and is singularly free from the lime which has been giving some trouble in the levels above. At the Pewabic the sinking of the shaft another 150 feet has been commenced. The hoisting is being done by one cage at present, but another cage will be put in as soon as finished. We hope to soon see the outlook at the Pewabic encouraging enough to warrant the sinking of a second shaft. Dr. N. P. Hulst, general manager, was a visitor of the mine this week. Shaft No. 2 at the Walpole, which is about 500 feet south of the present working shaft, is down about 85 feet. This shaft will probably reach the same jasper formation as that in which the operations at the Millie are being carried on, and it will no doubt, be very satisfactory to the owners if a body of ore equal in size to that of the Millie is encountered. At the old workings stoping is being continued, and some drifting, and the estimate of Capt. Barker as to the year's output will be fully reached.—[Current.

Lake Superior Shipments of Iron Ore:—

Shipments of iron ore from the mines of Lake Superior, for the season of 1889, up to Wednesday, October 2d, are as shown by the appended statement, condensed from the Marquette *Mining Journal:*

MARQUETTE RANGE.

American	12,577	Grand Rapids	5,007	Prout	5,550
Barnum	3,891	Hartford	524	Queen	44,856
Braastad	77,141	Humboldt	12,553	Republic	237,369
Bristol	1,836	Jackson	45,841	Republic Reduction Co.	17,624
Buffalo	29,480	Jackson, pit 7	11,754	Riverside	3,004
Buffalo, South	2,774	Jackson, pit 8	21,754	Salisbury	18,047
Cambria	49,816	Jackson, South	13,790	Salisbury Bessemer	24,697
Champion	159,865	Lake Superior	46,875	Samson	449
Cleveland	178,113	Lillie	27,339	South Buffalo	47,942
Cleveland, Hematite	46,393	Lucy	15,953	Superior	111,981
Cliffs shaft	100,567	Marquette	55,977	Superior, Hematite	72,775
Curry	14,813	Marquette Ore Co	2,721	Volunteer	34,996
Detroit	4,995	Michigamme	28,182	Webster	117
Dexter	3,895	Milwaukee	45,649	West Republic	1,062
East Champion	2,697	Negaunee	63,783	Wetmore	14,635
East New York	15,196	North Champion	7,109	Winthrop	17,800
Edison	893	Pitts. & L. Angeline	181,604	York	12,844
Total, Marquette Range					1,967,065

MENOMINEE RANGE.

Aragon	613	Half & Half	4,059	Norway	61,116
Armania	37,248	Hamilton	7,362	Paint River	21,839
Chapin	385,490	Iron River	132,284	Perkins	9,652
Commonwealth	75,505	Ludington	83,855	Shafer	4,931
Cyclops	28,418	Mastodon	46,873	Sheridan	504
Dunn	109,026	Mastodon, South	2,094	Sturgeon River	4,775
Florence	127,464	Millie	10,527	Vulcan	128,219
Great Western	30,423	Monitor	7,403	Walpole	9,616
Total, Menominee Range					1,329,684

GOGEBIC RANGE.

Anvil	30,878	Iron King	35,450	Pence	62,513
Ashland	193,895	Ironton	6,740	Ruby	7,374
Aurora	150,144	Montreal	6,549	Section 33 south	34,391
Brotherton	50,390	Norrie	473,490	Sellwood Colby	23,230
Cary	37,170	North Montreal	24,610	South Colby	42,903
Colby, Beaver	35,132	North Section 33	14,363	South 15 Colby	10,221
Germania	81,000	Odanah	4,334	Windsor	13,412
Globe	8,379	Pabst	77,436		
Iron Belt	39,883	Palms	9,960		
Total, Gogebic Range					1,473,868

VERMILION RANGE.

Chandler Mine	256,930	Minnesota Iron Co	431,725	Pioneer	2,168
Total, Vermilion Range					690,823
Grand Total					5,361,440

PROPOSED STEEL BRIDGE ACROSS THE ENGLISH CHANNEL.

The most remarkable event of the week, says the London *Iron & Steel Trades Journal* of September 28, occurred in Paris, on Tuesday, at the opening meeting of the Iron and Steel Institute, when a paper by M. Schneider, of Creusot, and M. Hersent, ex-president of the French Society of Civil Engineers, was read, which propounded an elaborate scheme for constructing a bridge across the Channel, between Cape Grisnez and Folkestone. M. Schneider is the greatest of French iron-masters, and M. Hersent is one of the most eminent engineers in France. The scheme, but that it emanates from such an influential source, would be ridiculed, but when Sir John Fowler and Mr. Baker, of Forth Bridge fame, are found endorsing the project of Messrs. Schneider and Hersent, the matter is, at least, deserving of careful consideration. For our own part, we doubt that there is any necessity for, or anything tangible to be gained by, railway communication, either over the sea or under it, with the Continent of Europe. The greatest benefit from a Channel bridge or Channel tunnel would be conferred on those who suffer from sea-sickness during the voyage across, which occupies about 90 minutes. For our own part we would rather, on a stormy night, descend into the bowels of the earth and pass under the waters, rather than take the elevated road proposed by Mr. Schnieder. The Tay bridge disaster is not yet forgotten, and of the two schemes, the tunnel would inspire more public confidence than the bridge.

The soundings taken, and examinations of the bed of the Channel, have convinced the promoters that there is no difficulty which cannot be overcome by engineering skill, and that suitable piers can be built to support the superstructure of the bridge from our island to the mainland of Europe. It is proposed to build the Channel bridge entirely of steel, and it is calculated that 1,000,000 tons of this metal would be required. The spans are to be 500 meters in length, and they would be supported on columns, the foundations of which would be laid in water varying in depth between 7 meters and 40 meters. The authors, of the paper read before the Iron and Steel Institute, have prepared very elaborate plans and estimates as to the quantity of material required, its cost, and the time necessary to carry out the works. They calculate that the cost of the masonry, including foundations for the piers, would be 380,000,000 francs, and the steel superstructure they estimate at 860,000,000 francs, the two sums equaling £34,400,000. The time they allow for constructing the bridge is ten years. The bridge is to be elevated from 61 to 63.78 meters above high water mark. The Forth bridge is 54 feet above high water. Seeing that the scheme has the support of the most experienced engineers, whose specialty is the construction of bridges, we are disposed to believe that it is possible to construct the bridge, as suggested by Messrs. Schneider and Hersent, but we suppose that the ship owners of the country have to be reckoned with, and we imagine that they will have a very decided objection to the waterway between England and France being obstructed by a row of "iron posts" stretching right across the Channel. We are told that none of the columns will be less than 100 meters apart, and that this distance will be sufficient to prevent their proving any obstacle to sailing vessels, and, besides this, it is urged that the current will be a little faster in the center of the spans and that this will prevent floating bodies from drifting against the piers.

Sir James Kitson, in closing the discussion on the Channel bridge scheme, said that, as an iron manufacturer, he looked on the project with some affection. He said that the engineers were ready, the materials could be obtained; in fact, nothing was needed except the £34,000,000, which the rich nations of France and England could supply. We believe the money might be obtained; but profiting by the experience of Sir Edward Watkin and the Channel tunnel shareholders, those who may be disposed to find the funds will want first to know that the scheme has the sanction of Parliament.

THE KEASEY PULLEY.

The careful study of all interested in any way in power plants is directed to the illustrations and description of the Keasey pulley, herewith given.

The former manufacturers, the Keasey Pulley Co., of Mishawaka, Ind., have recently moved their plant to Toledo, O., and consolidated with the Great Western Pin Co. With the advantages of a larger plant and better machinery, the pulley is better than ever, and new facilities for manufacturing and shipping are obtained that were impossible before.

The advantages of split pulleys in places where changes are necessary are well known and need no explanation. The superiority of a wooden face over iron and the saving in power transmitted, estimated at from 30 to 60 per cent., is also well known. The disadvantages of split wooden pulleys, heretofore, have been the impossibility of making them hold, and the warping of the rim, owing to the few points at which it was supported. The manufacturers think that a glance at the description of the Keasey pulley will convince the reader that these defects have been overcome in this pulley.

These pulleys are made of the best material and in the most substantial manner. The rim is laid up in segments of best yellow poplar, nailed and glued, to half the width of the intended face. The spokes are driven into iron half-hubs and secured by bolts passing through half flanges, spokes and hub, compressing them tightly. The center is then laid on the half-finished rim, the spokes are let into it and securely fastened by wooden dowels. The laying up of the rim continues till the right width of face is reached, when it is sawed

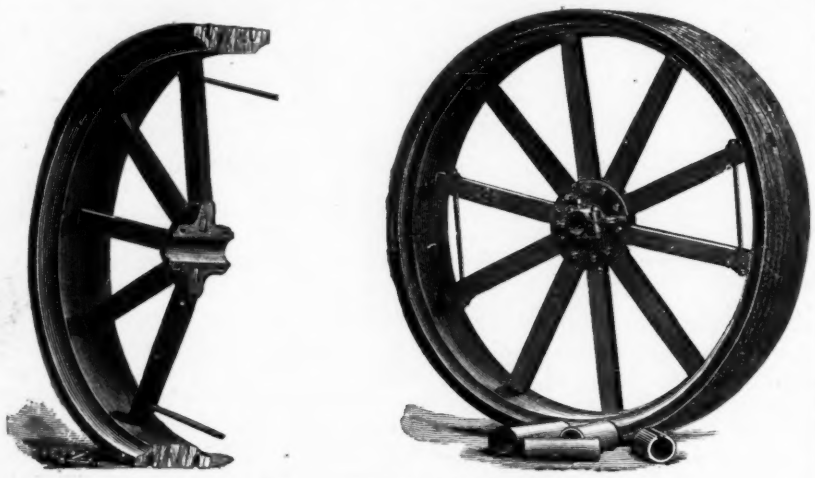


FIG. 1.—DOUBLE ARM PULLEY.

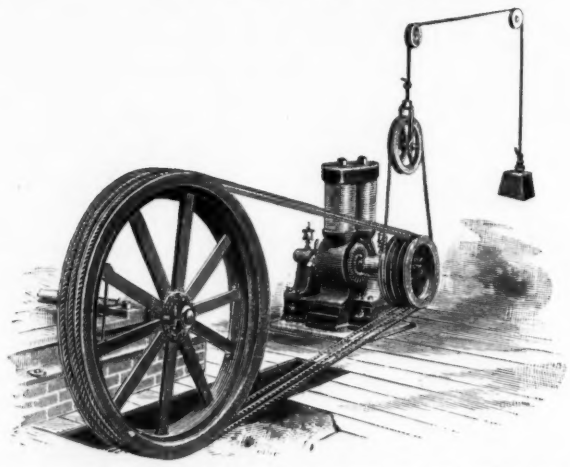


FIG. 2.—ROPE TRANSMISSION AS APPLIED TO DYNAMOS.

in two on a line with the division in the hub, dowels are let into the joint, the two halves are again clamped on an arbor and turned perfectly true.

The boxes are compressed against the shafts by four bolts, and in addition are furnished with two set-screws. The spokes, adjoining the split, are bolted together at the outer extremities, and the two halve are made as solid as if one piece. The objection that set-screws throw the pulley out of balance is overcome in this arrangement, as the boxes are already so tightly compressed against the shaft that the set-screw cannot force it out of true as in the case of a solid iron hub.

The spokes are of hard wood and are set with the narrow edge toward the resistance, giving greater strength. They themselves furnish no resistance to the air. This is an important factor in the consumption of power, some placing the power consumed, by using narrow arms, at from 30 to 50 per cent. less than when wide arms are used.

The hubs are made of the best cast iron. The spokes are driven into the hubs and the two flanges are clamped together by bolts passing through the spokes.

The makers' new bushing, a combination of wood and paper lining, has met with marked success. Bushings $\frac{3}{16}$ and under are all paper. Greater thicknesses are made of wood and lined with paper, but in no case does the paper lining exceed $\frac{3}{16}$ of an inch. This, it is claimed, gives a much better grip on the shaft than an all wood bushing and the solidity of a wood bushing is retained and the better friction surface of paper comes against the shaft.

For loose pulleys the manufacturers furnish sleeves of vulcanized fibre, two inches longer than the face of the pulley, which, aside from being lighter than iron, run much easier, and if allowed to become dry do not cut the shaft.

In general, the claims made for the Keasey pulleys are a saving in power, saving in belts, easily fastened and will hold tight when once set up, lighter than iron, no wide arms to fan the air and that paper bushings are better than wood. The pulleys are accurately balanced and will run true. Their Cleveland agents are Strong, Carlisle & Turney, 82 and 84 Water street.

THE MANUFACTURE OF OPEN-HEARTH BRIDGE STEEL.*

The specifications for bridge steel are usually not severe. The main difficulty is to secure a material which will roll easily, without showing signs of cracking on the corners of the blooms or on the flanges of the beams.

In many mills sulphur has been deemed the most harmful constituent in this respect. It has been thought hazardous to roll steel containing over 0.07 per cent. of sulphur. Yet, in making steel for the Phœnix Iron Co., I have produced from stock running as high as 0.13 per cent. of sulphur, a material which rolled very satisfactorily. It is reasonable to infer that the injurious effect of sulphur can be neutralized to a great extent, by proper treatment in the open-hearth furnace; and the following notes from my usual practice here may be of interest to those obliged to use high sulpur stock.

The steel made at Phœnixville in the 20-ton furnaces has about the following composition:

	Per cent.
Carbon	0.15 to 0.20
Manganese	0.50 to 0.60
Sulphur	0.11 to 0.13
Phosphorus	0.04 to 0.06
Silicon	0.01 to 0.02

The best running heats were made with a small quantity of pig iron. In using large proportions of pig the quantity of ore is also increased. This not only cuts the bottom, but also lengthens the time required to bring the charge down. Up to 50 per cent. of pig may be used, but 25 per cent. is much better. A 40,000-lb. charge, containing 10,000 lbs. of pig and 30,000 lbs. of Bessemer butts or beam scrap, works very well.

This is melted as quickly as possible. When every particle of the charge is thoroughly melted and the bath is hot, ore is added. If the ore is added before the charge is all melted, the cold ore chills the partly melted metal, and much time and heat are needed to make the bath perfectly fluid again.

In a charge containing 25 per cent. of pig, 1,000 lbs of hematite ore are usually required to bring the carbon to 0.16 per cent. This amount is weighed out, and "feeds" of 200 lbs. each are put in as fast as possible, the temperature of the bath being kept up.

With the bath in good condition, all the ore may be put in within one hour. During the addition of ore there should be a lively action throughout the metal; and, before all the ore has been put in an energetic "boil" should be visible all over the bath. The heat on the metal is now gradually increased, and the lively action is kept up for nearly an hour. With the decrease in carbon, the intensity of the action diminishes, and the slag becomes thicker and more viscous. At the end of one hour, after the last addition of ore, the bath becomes very quiet, the bubbles of gas formed are few, and break slowly through the slag. The metal, if exposed to view, presents a clear, silvery appearance. A test taken at this time usually breaks with a bright, coarsely-crystalline fracture, showing considerable toughness. The carbon is near the 0.16 per cent. point. If it be a few hundredths higher, the slight action in the bath will soon bring it to the desired point without further addition of ore. In case it be necessary, however, to add ore at this stage, sufficient time should be allowed, after the ore has entirely disappeared, for the bath to become tranquil before pouring. Steel treated in the furnace in this way should remain perfectly quiet in the molds when poured.

The ferro-manganese, in small pieces, is shoveled into the ladle while the stream is running out of the furnace. This method of adding ferro-manganese is most economical. The old way of throwing it into the furnace took twice the amount of ferro-manganese to give the same percentage of manganese in the finished metal. In making low steel I have noticed a loss of two-thirds of the manganese when added to the bath before pouring. By adding ferro-manganese in the ladle the loss is practically nothing.

This steel seems to work better when poured cool; but a large number of hot heats have rolled very well. The temperature of the ingot when bloomed down is a good red heat, noticeably colder than is the usual practice.

The steel is top-poured, making ingots 15 inches by 18 inches in size, and weighing 4,200 lbs. each.

The following physical tests were taken at random from a large number of heats. It will be noticed that the increase in the percentage of carbon is not always followed by an increase in tensile strength:

PHYSICAL TESTS OF OPEN-HEARTH STEEL.

(Test pieces 8 inches long, ¾-inch in diameter.)

No.	Tensile Strength. Per sq. in.	Reduction of area. Per cent.	Elongation. Per cent.	Carbon. Per cent.
1	57,100	65.3	25	0.15
2	64,100	62.6	26¾	0.18
3	61,200	61	31¼	0.18
4	66,700	53.8	24½	0.21
5	66,700	49.3	23¾	0.19
6	60,000	55.1	26¼	0.15
7	60,800	58.7	24¾	0.13
8	67,500	46.3	24¾	0.16
9	69,260	45.4	22½	0.22
10	60,320	54.1	30	0.17

American Boiler Manufacturers' Association.

The second meeting of this association will be held in Pittsburgh, Pa., Tuesday, October 15, 1889. This association has for its membership the leading manufacturers of steam-boilers of the United States, and the next meeting will be unprecedented in the history of the boiler business. All those in any way interested in the manufacture or sale of boilers of whatsoever kind, or those desirous of gaining information on the subject, are invited to be present.

* Paper read by Mr. N. W. Shed, before the Colorado Meeting of the American Institute of Mining Engineers.

SELF-FEED RIPPING SAW.

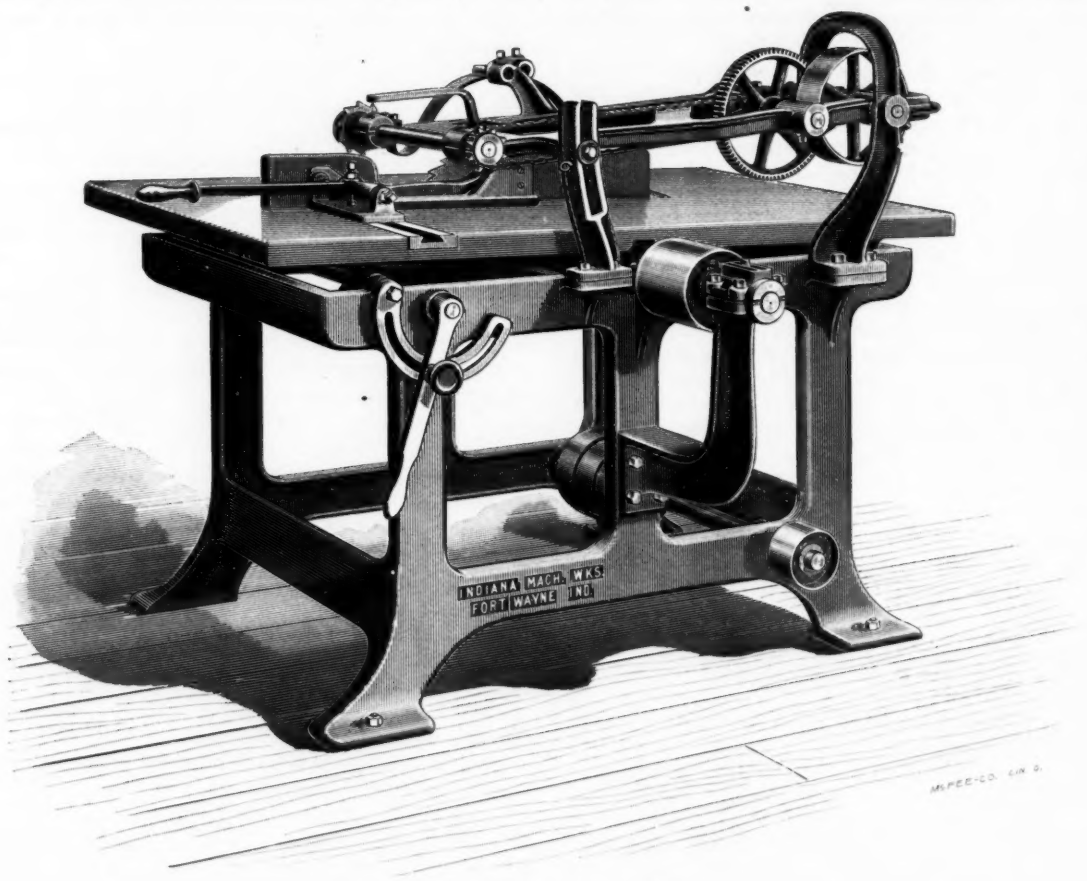
We present herewith an illustration of an improved self-feed ripping saw, intended to take the place of the hand-feed machine in planing mills, sash and door, furniture factories, etc. It has a substantial iron frame, cast in one piece; the arbor is large and of special steel; runs in self-oiling boxes, and has three bearings; the arbor is so arranged that several saws may be used at one time, if desired.

The feed is strong, and is derived direct from the arbor so as to be governed by the speed thereof at all times; the feed is a spur wheel made of steel, and arranged over the piece being ripped and in line with the saw. The feeding spur and frame can be raised or lowered to suit the thickness of material, or entirely thrown out of the way when it is desired to use the machine as an ordinary ripping saw. The table is hinged at one end and has eccentrics, easily adjusted to the desired length, at the other; the table has two friction rolls, one each before and after the saw.

The improved movable fence is quickly adjusted across the table to suit the operator. A spring hold-dowu and shield is placed over the saw, which serves as a guard and prevents accidents to the operator. It is attached to frame carrying feed works, and is adjustable to any position. The feed is also provided with a clutch, convenient to the operator, and the feed may be stopped or started instantly. There are three changes of feed, 60, 80 and 120 lineal feet per minute, and can be quickly changed from one feed to the other. Machine carries a 16-inch saw. Size of pulley on arbor is 7x6 inches, and should make 2800 revolutions per minute. For further particulars and price address the manufacturers, Indiana Machine Works, Fort Wayne, Indiana.

VIBRATIONS IN BUILDINGS BY RUNNING MACHINERY.

One of the most perplexing problems that confronts the engineer, is the vibration in buildings caused by running machinery. Messrs. Westinghouse, Church, Kerr & Co., of New York, being frequently called on to locate Westinghouse engines on the upper floors of buildings, have had a wide experience in this line, and have given the subject much thought. In determining these questions they say the character of building, the ground on which it rests, the weight, power and speed of engines are all factors which must be considered, some of which are very indefinite, or at least, their effect is hard to predetermine, combined with which is the very important influence, namely, the relation which the speed of the engine bears to the natural time of vibration of the floor beams. It is evident that if the slight motion which every engine has is exactly in time with the natural vibration of the floor beam, each pulsation of the engine will increase the scope of the vibration of the floor, resulting in a most disastrous shaking, while if the pulsations of the engine are in discord with the floor, comparative quiet will exist. As floor beams are usually long, and their time of vibration correspondingly long, it is usually found that a fast running engine will give less of its vibration to the floor beams than a slow running one. It is also worthy of note that the vibrations of a fast running engine are more numerous and less forcible, hence easier resisted by the mass of the floor.



SELF-FEED RIPPING SAW.

An interesting example of preventing vibration by discord was shown in the case of a Westinghouse 10 horse-power engine which, on an upper story of a silverware manufactory created such a commotion as to rattle the silverware on the shelves, a hundred feet distant. A change of 25 revolutions in the speed, which change was in the direction of increasing of the speed, entirely stopped the vibrations.

A most interesting work of this nature, also, is in the great coffee house of Arbuckle Bros., in Brooklyn, where two Westinghouse engines of 125 horse-power each, and one of 45 horse-power are located on the fifth floor. These engines were erected on the heavy floor timbers, the floor boards being cut away and extra timbers being inserted between the joists. Across said timbers were placed oak stringers, which latter have been seasoning since the war in some unfinished vessels in the Brooklyn Navy Yard. On these the engines were mounted with plain fly-wheels, and experiments were conducted to determine the speed at which it would be best to run. It was found that at 204 revolutions the vibration was at the minimum and was very slight, being as little as that caused by any of the ordinary driven machinery. The speed was, therefore, fixed at this point, and the wheels then made to give the proper belt speed.

The erection of engines as large as this on upper floors is somewhat novel, and should only be undertaken with full consideration of the surrounding conditions, and with engines which are completely balanced.

High Observation Towers.

The English speculators who have proposed building an observation tower in London, double the height of the Eiffel tower at Paris, and similar to it in plan, referred the matter to M. Salles, the assistant of M. Eiffel, for an opinion as to the practicability of the scheme. M. Salles is popularly supposed to have been the active engineer of the Eiffel structure. He has condemned the English idea, very possibly being biased by his connection with the Paris tower, which would lose its prestige if a higher rival should be erected. His argument, as reported by cable, may have been mangled in transmission, but as reported, it is this: That we are ignorant of the force of the wind at varying high elevations, and that there would be difficulty in transporting material above 1,000 feet. As to the first point the argument is weak. It is mainly a question of leverage, not of absolute wind power. As to the second point, that of transport of material, referrence to what is done every day, in deep mining, would show that there would be no difficulty. The whole thing is simply a matter of business. If the passenger tolls would pay interest, running expenses and profit on the enormous original outlay, the tower can be built. Engineering now-a-days is ready to face almost any difficulties when a profit can be shown

In our World's Fair of 1892, which will almost certainly be held on some portion of Manhattan Island, if the high tower scheme is to be one of the attractive features, it may be well to put in a word in season. The question of profit will depend principally on whether the popularity of ascents on high artificial structures lasts. But furthermore, we believe that passengers will be quite as willing to pay the same toll for a trip to a height of, say, 50 to 100 feet greater than that of the Eiffel tower, as it will be quite as satisfactory to be able to say that they have mounted to the top of the highest building in the world, as to take the trouble of going a few hundred or a thousand feet or so higher. The effect would be just as striking to the patrons, while the original cost to the projectors would be less, and consequently the profit would be far greater. If the English do build to 2,000 feet or more, then it would be necessary for us to go a few feet higher. If they give up their project, then a far lower structure would suffice. In this connection it will be remembered that the Washington Monument was designed to surpass in altitude the Great Pyramid by only five feet. All depends in brief, upon that capricious and fleeting element, popularity. The novelty of the thing is already gone.—[Engineering and Mining Journal.

Iron-making in Michigan.

The Marquette *Mining Journal* is firmly persuaded that bituminous iron can be very cheaply made in Michigan. It says: The ovens put in at West Superior by the Lehigh company a year ago, have been running up to their full capacity ever since they were started and the company intends to add one hundred more as soon as that can be done. Its purpose at first was to coke slack coal only, in order to save a heavy loss on its immense operations at the head of the lake through the accumulation of an unmarketable grade of coal, but the experiment on which it entered has demonstrated that coke making on a much larger scale and for a great variety of uses can be profitably carried on there. This, in the *Mining Journal's* belief, establishes that, with a coking plant in connection with a furnace here, Marquette is the best point in the whole country for an extensive coke iron industry, for we have here every variety of ore needed to produce any desired quality of iron, and at a cost so much lower than the same ores can be had at eastern furnaces as to give a furnace or mill located here an immense advantage over eastern competitors for the purpose of supplying the territory lying west and southwest of us.

THE Union Pacfic has ordered fourty-seven new locomotives for different branches of service.

EVIL EFFECTS OF THE OHIO GAS BOOM.

Mr. Charles Harrison, writing to the New York *Financial and Mining Record* on "Financial Plague Spots in Ohio," says: To obtain a verification of the adage "the better a thing is the worse are the effects of perversion; without a fallen angel it would be impossible to have a devil," one only needs to go to Northwestern Ohio and witness the conditions which have followed the introduction of natural gas as a fuel.

Municipalities have become financial plague spots and the disorder is growing. It is rapidly approaching culmination and the no distant future will witness the effects.

As a commercial agency to assist production, natural gas is one of the most beneficial of all modern discoveries, and without abuse or perversion would continue to be a blessing as long as utilized.

Like all other commercial agencies, its development and management belongs to commercial enterprise; its operation is a matter of business concern, the perversion that has taken place in Ohio arises from municipalities entering upon the business of supplying customers within their respective jurisdictions with the fuel, setting up natural gas plants at public expense, and conducting them as public or Governmental enterprises.

Findlay was the first to make the innovation; natural gas was utilized there in 1884. Prolific wells were developed within the boundaries of the city, a company of home capitalists was formed, which piped the gas from the wells to the houses of the people and to the manufactories. The distance was so short and connections could be made so directly that no mains were necessary. The expense was slight and the gas was furnished to consumers at 25 cents per stove per month.

This was decidedly cheap fuel in a locality where anthracite coal was selling at from $6 to $8 per ton, bituminous coal at $3 per ton, and wood at an average price of $1.50 per cord. Findlay was happy, its people enthusiastic over the comforts which had been introduced as well as the economy that had been realized.

The production of gas was greater than the consumption and it was going to waste. The utilitarian spirit was dominant and the first idea was, how shall this surplus production be utilized? The belief was that the wells were inexhaustible; here was gas enough to supply many more manufactories. If manufactories can be induced to locate here, the value of real estate will advance; the employment of labor will be greater, the population will be increased, commercial enterprises of all classes will expand, the whole city will be benefited! Why not drill wells at public expense and turn them over to manufactories free? The idea fell like seed in fruitful soil, and it was not long until the town was booming with free gas to incoming manufacturers.

The public authorities supplied gas to consumers at 15 cents per stove per month, the business company which had introduced the fuel was forced out of business and everything went as merry as a marriage-bell. The first excitation of the fever was delicious and was permitted to intensify until it amounted to almost a delirium. The newspaper press of the country was called into requisition to spread the glad tidings that Findlay had the greatest advantages of any place on earth for the supply of cheap and most desirable fuel, and its citizens were so liberal that they were giving it away to any manufacturer who would come and use it.

In good truth, the prospects were most promising; men who owned lands thereabouts and real estate speculators were not slow to see the harvest in store for themselves. So if there ever was a city in a position to be especially boomed on account of natural gas, it was Findlay. If there ever was a city in which the municipality should be able to conduct a natural gas plant economically and successfully, it was Findlay.

For a time the rush went on. Findlay boomed; there was nothing slow about Findlay. Immigration set in; annexes were made; streets laid out and graded on the adjacent farms; the sale of building lots went on swimmingly; manufactories, principally of glass, were erected in the vicinity; the facilities for transportation increased, and hope for the future smiled benignantly.

But within a few months a shadow began creeping over the animated scene. An increase in taxation became apparent. They found that every increase in the population o a city and enlarged area of assessment, does not result in a decrease of the debt per capita, nor a decrease of taxation. They found that the decrease in rate per stove was but temporary; that the authorities in their effort to prevent large deficiency in the natural gas account had advanced the price to 25 cents per stove per month, and the deficiency went on. The price was advanced to 50 cents per stove, or double what the company had charged, but still there was a deficiency to be made up by taxation.

The consumption had been increased, but the supply—what was becoming of that? The wells so "inexhaustible" were perceptibly weakening, and last winter there was scarcely enough gas in the lines for domestic purposes, and still there is a deficiency in the account.

In an application by the natural gas trustees recently presented to the council for a further appropriation for $40,000, wherewith to put the lines in condition for the coming winter, the somewhat interesting estimate is made that on January 1, 1890, the expenses of the gas plant will be $75,002.86, and the receipts $65,027.93, or an estimated deficit of $9,974.93, after advancing the price 233 per cent. over those first charged. The expenses for 1890 are estimated at $81,000, or considerably in excess of the present year, but they hope for a greater income. Whence? If the council grants this $40,000 it will swell the gas appropriation for this year alone to over $100,000, which, according to a local newspaper, "added to the previous expenditures, will make Findlay's bonded debt, on account of operating her own gas plant, so great that the receipts from gas will not pay the interest on the bonds, and the running expenses." This clearly bears no appearance of success.

Findlay is there as it was many years before natural gas was introduced; there is an end of the boom, but not an end of the town. The serious effects of the unhealthy growth have not yet been experienced. There is no unusual amount of taking of property to satisfy mortgages, because they are not generally due; but grass is growing on the graded streets on the farms; building is not going on vigorously, one of the manufactories has recently failed and business generally is quiet. The immediate situation is that between the check of an advance and the collapse of a bubble. Optimism still points to the future, but the future shows decreasing natural gas supply and that sums it all.

FOREIGN COMMENT.

The German Iron Trade.

The probable quantity of iron and steel to be used in the construction of the Dortmund-Ems Canal for bridges, locks, rails, etc., is, according to the information of the West German River and Canal Association, no less than 125,000,000 kilos. In this total quantity the rail rolling mills will participate to the extent of 60,000,000 kilos., the bridge building, switch, turn-table and engineering works to about 40,000,000 kilos, and the ship-building yards, etc., 25,000,000 kilos. The iron trade may thus be greatly enlivened by the canal construction.—[Kuhlow's German Trade Review.

New Process in Steel Maunfacture.

Hitherto the practice at all steel works has been to cog or hammer ingots into the forms of slabs, but the Barrow Hematite Steel Co. have recently erected a hydraulic press, which they intend to use for this purpose. The ingots will be pressed by means of a hydraulic ram into the form of slabs, and it is claimed for this new press that it will make the slab more homogeneous, and the metal generally a much superior material than by means of the hammering and cogging process now in vogue. Several experiments are to be conducted with a view properly to test this press, and its effect in solidifying the steel for future manipulation, and Mr. David Evans, the general manager of the works, is confident that the result will be highly satisfactory.—[Glasgow Engineer.

A Mammoth Gun.

A cast steel gun weighing 205 tons, has just been shipped by Messrs. Krupp from Hamburgh for Kronstadt. The calibre of the gun is 13¼ inches, the barrel is 40 feet in length, its greatest diameter being 6½ feet. The range of the gun is over 11 miles, and it will fire two shots per minute, each shot costing $1,250 to $1,500. At the trials of the gun, held in the presence of Russian officers at Meppen, the range of the Essen firm, the projectile, 4 feet long, and weighing 1,800 pounds, and propelled by a charge of 700 pounds of powder, penetrated 19½ inches of armor, and went 1,312 yards beyond the target. The gun, which is the largest in existence, and the heaviest yet exported by Messrs. Krupp, had to be carried from Essen to Hamburg on a car specially constructed for that purpose.

A New Puddling Process.

An English contemporary says: Experiments are being made at a leading iron works in West Bromwich, which, if successful, will effect a revolution in the iron trade. During the past fortnight, water-gas has been used for the heating of puddling furnaces instead of coal, and, so far, the experiments have yielded the most gratifying results. It is found that the new process will heat the furnace to any degree of temperature, almost to the same intensity as a Siemens-Martin furnace, and the economy is considerable. At least half the cost of the present consumption of fuel will be economized. In addition, the labor of firing the furnaces will be avoided, and the temperature can be regulated in the most simple and effective manner. The progress of the experiments will, therefore, be watched with interest by the whole trade. Another advantage will be that it will do away with the escape of carbonaceous gas.

The Modification of Ironworks for Steelmaking.

Ironmasters who find that they can make money also out of steel have not hitherto failed to enter upon the new business with a tolerable amount of freedom in several of the trade centres. The readiness with which ironworks plant can be adapted for this purpose is favorable to modifications of this sort. It is interesting to note that these alterations of works are increasing in frequency. One of the latest instances in point is afforded in the announcement from South Staffordshire that one of the largest blast-furnace owners there is about to lay down a steel plant; and it is believed that the preparations will involve the utilization of existing iron-making plant. Where old puddling furnaces are idle, they can be pulled down, and the materials used in erecting Siemens basic furnaces with a capacity of from 15 to 25 tons each. The cost of such furnaces would be about £1,500 each, after allowing for the old materials worked up. If a manufacturer possesses boilers, etc., standing, as well as a forge train, he can adapt them to a cogging plant, a process which might involve an extra expenditure of £5,000 or £6,000. It is probably upon some such lines as these that the new works would be laid down. There are already five firms in the South Staffordshire district making steel, and the announcement of a new competitor is exciting considerable interest in the midlands. It is understood that the chief product will be steel bloom.—[London Iron.

Sales of Pig-Iron Warrants.

We are informed that the aggregate sales of pig-iron on warrants thus far are equal to abont 35,000 tons. Since, however, the greater part of this iron is yet to be made, embracing chiefly December delivery, and some later, the actual aggregate of warrants issued is about 8000 tons. It is stated that at least one furnace in the South, soon to blow in, will run entirely on warrant iron, and that others are contemplating similar action.—[Iron Age.

INDUSTRIAL SUMMARY.

New Enterprises :—

The Hoffman & Billings Manufacturing Co., Milwaukee, Wis., is building a large brass foundry.

Contracts have been let for building the shops of the Milwaukee Car Wheel & Foundry Co., at Milwaukee, Wis.

The Tennessee Coal, Iron & Railroad Co. will erect car works, foundry and machine shop at Ensley, Ala., to cost $60,000.

The Findlay Iron & Steel Co. and the Briggs Edge Tool & Rolling Mill Works, of Findlay, O., have merged into the Findlay Rolling Mill Co., incorporated with a capital stock of $100,000, and the two establishments, under the superintendence of Mr. Briggs, are running full force, with abundance of work on hand.

The following articles of incorporation were filed in the office of the Secretary of State at Columbus, O., last week: The J. B. Miller Co., Kent, increase of capital stock from $50,000 to $100,000.—The Western Weighing Machine Co., Cincinnati, capital stock $25,000.—The H. K. House Manufacturing Co., Kent, increase of capital stock from $15,000 to $30,000.

The Crescent Steel Co., of Pittsburgh, with a capital stock of $1,000,000, was chartered last week. The directors are Reuben Miller William Metcalf and Charles Parkin. The firm were formerly known as Miller, Metcalf & Parkin, or the Crescent Steel Co., Limited. The limited partnership has been dissolved and the company incorporated. No extensive improvements to the plant are contemplated.

A dispatch (Sept. 27) from Lebanon, Pa., says: Messrs. John R. White, W. B. Reed, L. S. Allison and Joseph McKnight, of Philadelphia, to-day joined a number of Lebanon capitalists and visited Colebrook Station, along the line of the Cornwall & Lebanon Railroad, about one mile from Mount Gretna, with a view of locating works there, for the manufacture of the Fottrell insulated wire. The company has a capital of $1,000,000, and there is every indication that the works will be in operation before January 1.

Enlargements, Additions, Removals, etc.:—

There is some talk of building a second Pulaski furnace at Roanoke, Va.

The Enteprise Boiler Works Co., Youngstown, O., is making arrangements to build an addition 45 by 130 feet to their works.

The plant of the Wetherald Wire Nail Co., Findlay, O., has passed into the hands of the Salem (O.) Wire Nail Co., who are making extensive additions and improvements, and are already running the old works to full capacity.

The Wisconsin Malleable Iron Co. are making extensive additions to their plant at Milwaukee, Wis. A new foundry is being erected which will be 67 feet wide by 297 feet long. The capacity of the works will be almost doubled by these enlargements.

The Sharon Steel Casting Co., of Sharon, Pa, is enlarging its works by the erection of a machine shop 60x80 feet and two and a half stories in height. The works of the firm are being operated to their utmost capacity, and have enough orders on hand to keep them busy for some months.

It is currently reported that plans are being prepared for extensive additions to the Illinois Steel Co.'s South Chicago plant. A plate mill of the most modern type is one of the projected improvements. It will be equipped with open hearth furnaces. The blast furnaces are also to be increased in number, perhaps doubled.

The Oxford Iron & Nail Co., of Oxford, N. J., have begun a series of improvements in connection with the rolling mill department of their works. All the reheating furnaces have been equipped with anthracite gas-producers, with results which are pronounced gratifying so far as it has been possible to gauge their effect from a short trial.

The Allegheny Bessemer Steel Co. is making an important addition to their steel rail mill at Duquesne. A contract has been let to the Swindell & Smythe Construction Co., of Pittsburgh, for a soaking pit furnace, which will be built at once. This will increase the capacity of the works fully one-fourth. Other improvements are contemplated and the mill is working full, indicating prosperity in the steel rail business.

The Carp River Furnace, at Marquette, Mich., which was partly destroyed by fire some years since, is being reconstructed with a view to resumming the manufacture of charcoal pig iron. It will be operated by the Carp River Furnace Co., in which Burt Brothers, of Detroit, have a large interest. Hiram A. Burt is at present secretary and treasurer, and Solon Burt, general manager, but in view of other interests requiring their attention, the management will probably devolve on Charles S. Burt. The old stack is in good condition, not even requiring relining, but new buildings and new equipment had to be supplied. It will be ready for blast about December 1.

General Industrial Notes :

Brownell & Co., of Dayton, O., have made for the Southern Cotton Oil Co., of New Orleans, eight tanks, each 18 feet high by 9½ feet diameter, with steel "jackets," giving 6 inch steam space. They are for the manufacture of soap.

The Lima (O.) Machine Co. shipped recently seven car-loads to San Francisco, Cal., consisting of one Shay locomotive and a supply of logging cars. The orders were for the Usal Lumber Co., on the coast above San Francisco, and the Sonomo Lumber Co., Gurneyville, Cal.

Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 28th day of October, 1889, for furnishing and putting in place, complete, two hydraulic passenger elevators, and one steam mail lift, for the U. S. Postoffice, etc., at Minneapolis, Minn.

The second stack of Wellston furnace will soon be ready to put in blast. The master commissioners will offer the Eliza furnace property for sale again on November 2d. The Wellston Furnace Co. made the best record last week that she has made since she was built. Her output for the week was 177.7 tons, an average of over 25 tons per day. Of this amount, 165 tons was No. 1 foundry iron. The largest output in any one day last week was 27½ tons. Manager Clutts says he will make her do still better than this.—[Wellston (O.) Argus.

The Walker Manu acturing Co., Cleveland, have just been awarded the contract for cable-winding machinery for a plant to be built in Portland, Ore., by the Pacific Cable Construction Co., San Francisco, Cal. This plant will be driven by cotton ropes instead of gearing. This plant is in addition to the one recently contracted for in Seattle.

Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 25th day of October, 1889, for all the labor and material required to fix in place, complete, a low-pressure return-circulation, steam heating and ventilating apparatus, for the Postoffice building at Ottumwa, Ia.

At the Oliver Oil Co.'s mill, at Charlotte, N. C., there is a 65 horse-power Westinghouse engine, which has been operated night and day (starting 12 o'clock Sunday night and stopping 12 o'clock Saturday night) for five years, and during that time it has not cost five dollars for repairs, and the mill has never stopped a minute on account of the engine.

Tin Plate Manufacture Resumed.

The first tin plate to be made complete in this country for the past 20 years or more is now being manufacured at the Exposition, says the Pittsburgh *Dispatch* (Oct. 2). Yesterday the plant was put into operation, and the lawmakers of the nation will now have a practical demonstration that tin plate can be made in this country. The plant at the Exposition is in the west end of the building and was established by the American Tinned Plate Association.

The object of the establishment of the plant in Pittsburgh is to awaken the interest of the public in the matter and practically demonstrate that tin plates can be made here as well as anywhere else in the world. The plant was started yesterday afternoon, and will be under the charge of John D. and Daniel Morgan, two experienced tin plate workers.

The block iron or steel plates from which the tin is made, are manufactured in the rolling mills in this. It is first pickled in diluted sulphuric acid city in order to take off the oxid which accumulates in the annealing process. After doing this it appear as a white sheet. It is then rinsed and washed to take off the acid. The block is then bathed in palm oil and soaked for a few minutes. This makes it ready for the tin pot, where the plate gets the actual "tinning." It is then laid on the washman's plate and afterward put in the washpot, containing a high grade of refined tin. After that the block is polished with a hempen brush and lowered into another bath of palm oil. It is then rolled through five highly polished rolls, and afterward cooled off. It is then placed in a box of bran, and from there goes into a box of middlings, where it is cleaned. The plate is laid on a table and polished with a sheep skin. The tin is then branded according to its quality. The defective material is called water plate.

W. C. Cronemeyer, secretary of the association, stated yesterday that the process they had is better than the method of making the plates in England There they "flux" them and this often leaves impurities under the surface of the tin coating. These defects are known as pin holes. The tin made yesterday could be bent and twisted in every way but the coating would not crack or come off.

Electric Welding.

A recent issue of the Boston *Herald* stated that the Thomson Electric Welding Co. believes it has passed the experimental stage and has now begun to do busines for direct revenue. Its career has been brief, and dates from late April, 1888. It was only in January of this year, when it became settled in its new factory, that the company settled down to work. It has now some 75 welding machines built and in use or in process of construction. Not a single machine has been returned to the company for failure to accomplish what it was expected to do. The company builds the machines and leases them for a price to equal their cost. It then charges a royalty for each set of welding, and the machines are self-registering. It has taken some months for the company to determine the basis of royalties, and for obvious reasons. The general principle established is that the company shall receive 33 per cent. of the saving of this method of welding over the old methods, but this method being entirely new it could not be told, without experiment, what the gross saving was. Until now, the company has made little effort to place its machines. It will now set agents at work and cultivate the field systematically. What the revenues will be cannot be told exactly, but they promise to be large.

A New Process of Welding.

The Redeman-Telford Steel Co., of Louisville, Ky., says the *Age of Steel*, are continuing to make experiments with their new process. Their recent experiments have been chiefly with laminated steel. Two or more sheets of steel treated by their process, with iron sheets sandwiched in between the steels, have been welded together in one heat. After being taken from the fire it requires a great deal of force to separate the layers, and after they have been rolled once, the welding is so firm that it is quite impossible to separate them. The Hall Safe & Lock Co have experimented with the Redeman-Telford steel, and are said to pronounce it superior to their own laminated steel, made at great expense. The Redeman-Telford steel after treatment is very soft, and holes are easily punched in it; but after tempering, it is almost impossible to drill a hole into the sheets, with the finest tools made of Mushet steel. The tempering is effected by heating the iron once, and then immersing it in cold water. Specimens of the tempered Redemann-Telford steel were submitted to the Navy Department, and naval officers say that the process seems to be a rediscovery of the lost art of making Damascus steel.

STEEL RAILS AT HOME AND ABROAD.

The market for steel rails in the United States continues very firm. The *Iron Age* says: Rails for delivery the next three months seem difficult to obtain at any concession on quoted prices, so closely is the output of all the mills sold up. Eastern agents quote $29, at works, as bottom price for heavy sections and report quite numerous inquiries, including several for large lots for 1890 delivery. Reports from Pittsburgh and Chicago indicate that prices are relatively as high there, and the demand as good in those sections as in this quarter. One of the trunk-line railroad companies has purchased 5,000 tons at $29 at works, Scranton, Pa., with the option of taking a further 5,000 tons at the same price. A Southern order for 8,000 tons has been placed at $29 at an Eastern mill, and another for a similar quantity, Winter delivery, on special conditions, making the cost to the buyer considerably above the cash market price.

Of the British steel rail export trade, the *Iron & Coal Trades Review*, says: Our exports of steel rails last month show a decline, as compared with August of last year, the figures being 67,000 and 70,000 tons, respectively. This difference of 3,000 tons is, however, counterbalanced by a difference in values of £14,000—a proof that if the demand is slow, prices are fairly satisfactory. It is not a little instructive to note the fluctuations which this branch of our trade has undergone during the past three years with certain countries—notably with Italy, Russia and the United States—as they afford evidence of the progress which some of our former customers are making towards the supply of their own wants in this particular class of manufactures. Thus, in August, 1887, Italy took from us 2,300 tons of steel rails, as against 24 tons last month. Again, the United States in August, 1887, was supplied by us to the extent of 19,300 tons—the quantity sent in the corresponding month of 1888 was only 840 tons. Russia, in August, 1887, ordered 2,850 tons from us; her requirements last month declined to 1,000 tons. In these three instances the falling off in our exports of steel rails was directly due to hostile tariffs, and, however much we may regret it, nothing is gained by ignoring the fact. Despite these drawbacks, our exports for the eight months ended with August are 14,000 tons beyond those of the same period, both of 1888 and 1887. British North America, Chili, Mexico, and the Argentine Republic are buying pretty freely, especially the Argentine Republic, which, last month, took 10,000 tons of material from us. The much-talked-of introduction of the railway system into China and Japan seems yet a long way off, as our exports to those countries during the last two years have been almost *nil*. Railway enterprise in South Africa appears to be also at a standstill, and the same may be said of the British East Indies and British North America. Those mysterious regions known as "other countries" are increasing their purchases slightly, but the returns, as a whole, do not indicate that our steel rail export trade has that elasticity which characterizes various other branches of our manufactures.

ALMOST the hardness of the diamond is said to be given by German workmen to steel engraving tools. The tools are made white hot, plunged repeatedly into sealing wax until cold, and then just touched with oil of turpentine.

JAMES P. WITHEROW

ENGINEER AND CONTRACTOR,

LEWIS BLOCK, PITTSBURGH, PA.,

GENERAL AGENT FOR

Whitwell Fire-Brick Stoves and Clapp-Griffiths Patents

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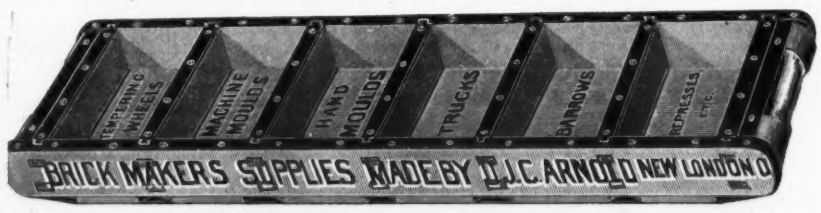
Specially adapted for A No. 1 Boiler Plates, Boiler Rivets, Wire Rods, Stay Bolts, Stamping Ware, Nail Plates, etc. Will contract to completely erect, equip and place in operation blast furnaces, Whitwell stoves and steel plants as above. As I manufacture at my own works, everything appertaining to blast furnace and steel works construction I can guarantee promptness and satisfaction.



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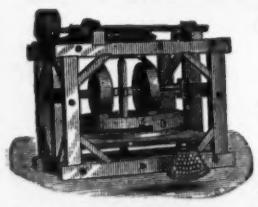

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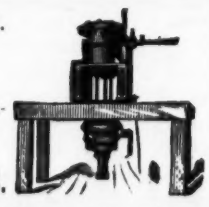

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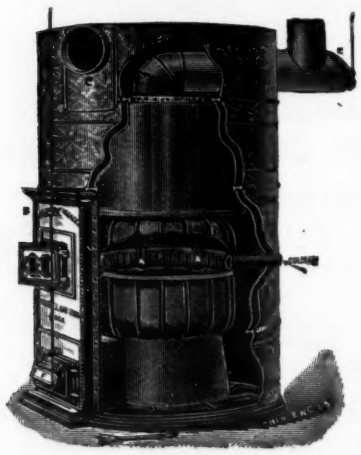

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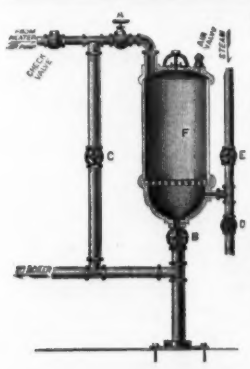

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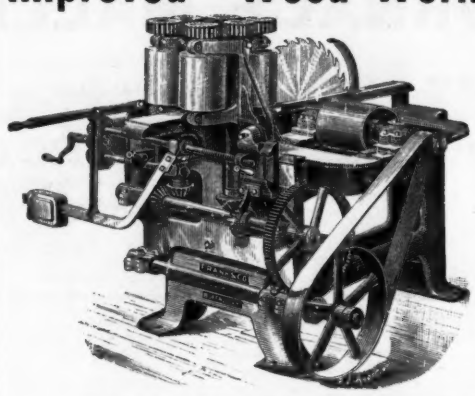

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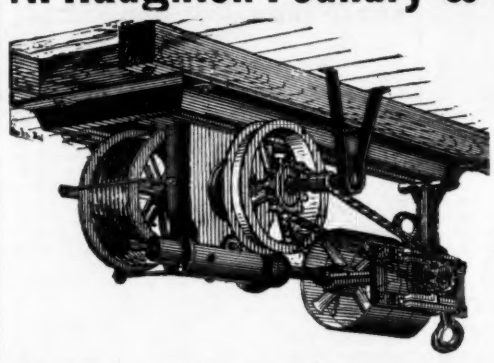

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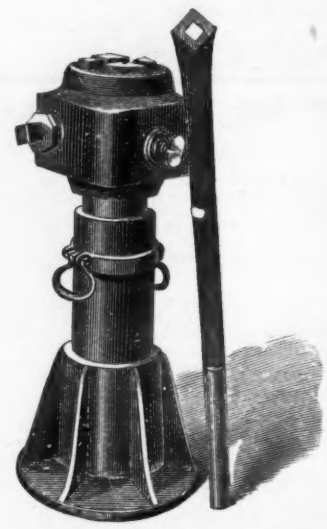

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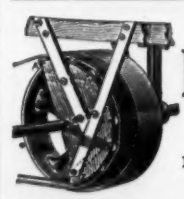

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CHICAGO (reported by Rogers, Brown & Co.): COKE AND BITUMINOUS—Southern No. 1 Foundry, $16 75@17 00; Southern No. 2 Foundry, $16 25@16 50; Southern No. 3 Foundry, $15 50@15 75; Southern No. 1 Softener, $16 25@16 50; Southern No. 2 Softener, $15 25@15 50; Southern Gray Forge, $15 25@15 50; Southern Mottled, $14 50@15 00; Ohio, Jackson Co. Silveries No. 1, $18 00@00 00; Ohio Jackson Co. Silveries No. 2, $17 00@00 00; Hocking Valley Silveries No. 1, $17 75@18 00; Hocking Valley Silveries No. 2, $16 75@17 00; Norton Kentucky Silveries No. 1, $17 75@00 00; Norton Kentucky Silveries No. 2, $16 75@00 00; Ohio Strong Softeners No. 1, $18 25@18 50; Ohio Strong Softeners No. 2, $17 25@17 50; Hamilton, Hanging Rock, all ore No. 1, 18 25@18 25; Hamilton Hanging Rock, all ore No. 2 17 25@17 50. LAKE SUPERIOR AND SOUTHERN CHARCOAL FOUNDRY—Lake Superior Charcoal Nos. 1 & 2, $19 00@19 50; Alabama Charcoal Nos. 1 & 2, $22 00@23 00; Tennessee Charcoal No. 1, $18 50@19 00; Tennessee Charcoal No. 2, $17 50@18 00. MALLEABLE AND CAR WHEEL—Lake Superior Charcoal Nos. 1 to 6, $19 00@20 00; Southern Alabama Nos. 1 to 6, $22 00@24 00; Tennessee Nos. 1 to 6, $18 50@19 50; Hanging Rock Warm Blast Nos. 1 to 6, $22 00@24 00; Hanging Rock Cold Blast Nos. 1 to 6, $26 00@28 0; Southern Cold Blast Nos. 1 to 6, 26 00@26 50.

CINCINNATI (reported by Rogers, Brown & Co.): HOT BLAST FOUNDRY—Ohio and SouthernCoke No. 1, $15 50@16 00; Ohio and Southern Coke No. 2, $15 25@15 50; Ohio and Southern Coke No. 3, $14 75@15 00; Ohio Soft Stone Coal No. 1, $16 50@17 00; Ohio Soft Stone Coal No. 2, $15 50@16 00; Hanging Rock Charcoal No. 1, $20 00@22 00; Hanging Rock Charcoal No. 2, $19 00@21 50; Tennessee and Alabamba Charcoal No. 1, $17 50@18 50; Tennessee and Alabama Charcoal No. 2, $16 50@17 50. FORGE—Strong Neutral Coke, $14 50@14 75; Mottled Neutral Coke, $13 75@14 00; Cold Short Coke, $14 00@00 00. CAR WHEEL AND MALLEABLE—Southern Car Wheel, $23 00@24 00; Hanging Rock Cold Blast, $22 00@25 00; Lake Superior Malleable and Car Wheel, $20 00@21 00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry (new classification), $15 00@15 50; Southern Coke No. 2 Foundry (new classification), $14 50@15 00; Southern Coke No. 3 Foundry (new classification), $13 75@14 25; Grey Forge, $13 25@13 75; White and Mottled, different grades, $12 75@13 25; Silver Grey, different grades, $13 25@13 75; Southern Charcoal No. 1 Foundry, $16 50@17 00; Southern Charcoal No. 1 Mill, $15 00@15 50; Southern Car Wheel, Standard brands, $22 00@23 00; Southern Car Wheel, other brands, $18 25@19 75; Hanging Rock Coke No. 1 Foundry, $15 75@16 25; Hanging Rock Charcoal No. 1 Foundry, $19 75@21 25; Hanging Rock Cold Blast, $21 00@23 00; Hanging Rock Warm Blast, $00 00@00 00.

LOUISVILLE (reported by Hall Bros. & Co.): HOT BLAST FOUNDRY—Southern coke No. 1, $15 50@15 75; Southern coke No. 2, $14 75@15 00; Southern coke No. 3, $14 50@14 75; Mahoning Valley (Lake ore mixtures), $18 50@19 50; Southern charcoal, No. 1, $17 50@18 50; Southern charcoal, No 2, $16 75@17 50; Missouri charcoal, No. 1, $19 00@19 50; Missouri charcoal,No. 2, $18 50@19 00. FORGE—Neutral coke, $14 00@14 25; Cold short, $13 75@14 00; Mottled, $13 25@13 50. CAR WHEEL AND MALLEABLE—Southern (standard brands), $23 00@23 75; Southern (other brands), $18 50@18 50; Lake Superior, $22 00@22 50.

ST. LOUIS (reported by Rogers, Meacham & Shields): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $16 00@16 50; Southern Coke No. 2, $15 50@16 00; Southern Coke No. 3, $15 00@15 50; Southern Grey Forge, $14 75@15 00; Southern Charcoal No. 1, $18 00@18 50; Southern Charcoal No. 2, $17 00@17 50; Missouri Charcoal No. 1, $17 00@17 50; Missouri Charcoal No. 2, $16 00@16 50; Ohio Softeners, $18 00@20 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $21 00@22 00; Southern, $19 00@24 00. CONNELLSVILLE COKE—East St. Louis, $5 00; St. Louis, $5 15.

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DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $19 25@19 75; Lake Superior Coke, all Ore, $18 50@19 50; Lake Superior Coke, Cinder Mixed, $17 50@18 50; Standard Ohio Black Band, $18 00@18 50; Southern No. 1, $17 00@17 50; Southern Gray Forge, $15 50@16 00; Southern Silvery, $16 50@17 00; Jackson County (Ohio) Silvery, $18 00@18 50; Old Wheels, $18 50 @19 50; Old Iron Rails, 25 00@25 50.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $18 00@18 25; No. 2 Foundry, $17 00@17 25; Grey Forge, $16 25@16 50; White and Mottled, $14 50@15 00; Warm Blast Charcoal, $18 00@25 00; Cold Blast Charcoal, $24 00 @18 00; Bessemer, $19 00@19 50.

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1¾ to 6 by 1⅛ to 2 inch	2 20
1¼ & 1⅜ by ⅜ to ¾ inch	1 90
1 & 1⅛ by ⅜ to ¾ inch	1 90
⅝, ¼ and ⅞ by ⅜ to ⅝ inch	2 30

Round and Square.

1 to 1⅜ inch	1 80
2 to 2⅜ inch	2 00
2¾ to 3¼ inch	2 30
3⅜ to 4 inch	2 80
4¼ to 4½ inch	3 30
4¾ to 5 inch	3 50

Oval.

⅞ to 1¼ inch	2 20
⅝ to ¾ inch	2 40
½	2 60
⅜	3 00

Half Oval and Half Round.

1½ to 3 inch	2 90
⅞ to 1¼ inch	2 50
⅞ to ¾ inch	3 00
½	3 30
⅜	4 80

Heavy Band.

½ to 6 by ¼ and 5-16 inch	1 95
1 to 1⅜ by ¼ and 5-16 inch	2 05
¾ to ⅞ by ¼ and 5-16 inch	2 25
½ to ⅝ by ¼ and 5-16 inch	2 75

Hoops.

1¼ to 4, Nos. 13 to 15	2 65
1¼ to 2, Nos. 16 to 18	2 75
1¼ to 2, No. 19	2 85
1¼ to 2, No. 20	2 95
1¼ to 2, No. 21	3 05
1¼ to 2, No. 22	3 15
15-16, 1 and 1⅛, Nos. 13 to 15	2 85
15-16, 1 and 1⅛, Nos. 16 to 18	2 95
15-16, 1 and 1⅛, Nos. 19 and 20	3 05
15-16, 1 and 1⅛, No. 21	3 15
15-16, 1 and 1⅛, No. 22	3 35
⅞, Nos. 13 to 15	2 05
⅞, Nos. 16 to 18	2 15
⅞, Nos. 19 and 20	2 25
⅞, No. 21	3 35
⅞, No. 22	3 45
13-16, Nos. 13 to 15	3 25
13-16, Nos. 16 to 18	3 35
13-16, Nos. 19 and 20	3 45
13-16, No. 21	3 55
13-16, No. 22	3 65
¾, Nos. 13 to 15	3 35
¾, Nos. 16 to 18	3 45
¾, Nos. 19 and 20	3 55
¾, No. 21	3 65
¾, No. 22	3 75
11-16, Nos. 13 to 15	3 55
11-16, Nos. 16 to 18	3 65
11-16, Nos. 19 and 20	3 75
11-16, No. 21	3 85
11-16, No. 22	3 95
⅝, Nos. 13 to 15	4 05
⅝, Nos. 16 to 18	3 85
⅝, Nos. 19 and 20	4 05
⅝, No. 21	4 15
⅝, No. 22	4 25
⅝, No. 23	4 35

Light Band.

1½ to 6 by 1/16 to 3-16 in	2 25
1½ to 6 by Nos. 11 and 12	2 35
1 to 1⅜ by 1/16 to 3-16 in	2 35
1 to 1⅜ by Nos. 11 and 12	2 45
⅞ and 13-16 by 1/16 to 3-16 in	2 65
⅞ and 13-16 by Nos. 11 and 12	2 75
¾ and 11-16 by 1/16 to 3-16 in	2 95
¾ and 11-16 by Nos. 11 and 12	3 05
⅝ and 9-16 by 1/16 to 3-16 in.	3 25
⅝ and 9-16 by Nos. 11 and 12	3 30
½ by 1/16 to 3-16 in	3 50
½ by Nos. 11 and 12	3 60

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⅞ inch, beveled edge, by Nos. 11 and 12	2 75
⅞ inch, " " " 13 and 14	3 05
¾ inch, " " " 11 and 12	3 05
¾ inch, " " " 13 and 14	3 25

Sheet Iron.

No. 10 to 14	2 60
No. 15 to 17	2 80
No. 18 to 21	2 90
No. 22 to 24	3 00
No. 25 to 26	3 10
No. 27	3 20
No. 28	3 40

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Tank, ¼ inch and heavier	2 40
C No. 1, " "	2 65
C H No. 1 " "	2 90
C H Flange, " "	3 60
Extra Flange, "	4 00
Solid Fire Box, "	4 90

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 65
Shell	3 05
Flange	3 30
Marine Flange	3 80
Fire Box	4 45

Above includes plates 90 inches wide.

90 to 96 in. wide	½c ℔ extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1½c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. ℔s
1 to 2 in. inclusive	09
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3-6 in	14

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2 to 9-16 wide by 2 to ⅛ thick	0

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Tire	" 02¾
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Jessop's	16c
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½, ⅝, 11-16 and ¾ inches diameter	4 00
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Tank iron	12 50
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Sheet iron	8 00
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Old iron T rails	24 00
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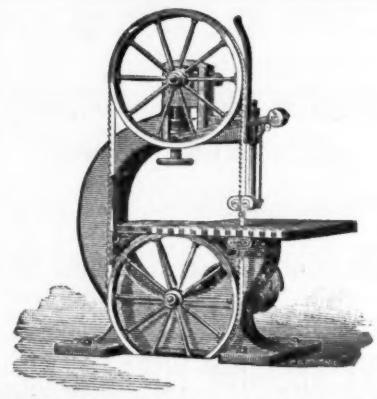

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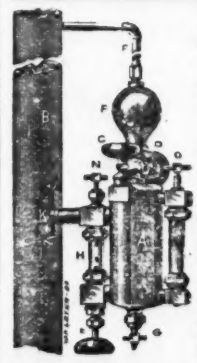

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American.....₩ lb 9@10
Wrights.....₩ lb 9½

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's.... dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70@70& 5
" " " extra.....dis 60&5@60&10
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard .dis 60&10
Shultz Raw Hide Leather Belting, single.....dis 30
Shultz Raw Hide Leather Belting, double.....dis 35
Standard, oak tanned.....dis 55@60
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 9½@10½

Chalk.

White .....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 40
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers. .....dis 25
" Drill.....dis 35
Wescott's Scroll Combination.....dis 30
" Independent.....dis 40
" Little Grant Drill.....dis 30
Horton's Universal & Ind.....dis 40
National Combination.....dis 40
Sweetland " .....dis 40
Skinner " .....dis 40
" Independent.....dis 40
Almond Drill.....dis 25
Morse " .....dis 15
Skinner " .....dis 30

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" " Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Stocks.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1½".....dis 50&10
Morse Taper and Straight shank Larger than 1½".....dis 25
Drill Sockets.....dis 25
Standard.....dis 50&10
Cleveland.....dis 50&10
Maneer's bench.....dis 50&25
Maneer's post.....dis 50&10

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2½c
¼ kegs ₩ lb	4¼c	5¼c		2¾c
¼ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
10 lb cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 40@46
H. H. Barton.....dis 40@46

Emery Wheels.

Detroit.....dis 50@60
Norton's.....dis 55@60
Grant.....dis 55@60
Union Stone.....dis 60
Sterling.....dis 60
Vulcanite.....dis 15@20
Celluloid.....dis 10
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 65@70
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¼	4	3¼	3½
Hexagon	15½	11½	8½	6	5¼	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.)

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate
{ Car lots.....$2.30 / Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 70
Sheet Rubber.....₩ lb 12@24
Excelsior Rubber.....₩ lb 46

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 45

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ½ inch and over.....₩ lb 15¾
Sisal, ½ inch and over .....₩ lb 13¾

Sand Paper.

B. A. & Co.....dis 40@40&10
H. H. Barton's.....dis 40@40&10
New England Flint.....dis 40@40&10
Barton's Garnet.....dis 25

Saws.

Disston's Circular.....dis 45
" Band.....dis 20
" Scroll .....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 20
Atkins' Cicular Saws.....dis 50
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 32c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay .....dis 45

Screws.

Wood Screws—List Jan 27, 1889.

Flat head iron.....dis 50
Round head iron.....dis 40
Flat head brass.....dis 45
Round head brass.....dis 35
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 55
Machine, round head, iron.....dis 50
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ lb Balls	21c@29c	
No. 18 " " ¼ and ½ "	18c@28c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ½ lb Balls (Spring Twine)	11½c	
3-Ply " 1lb Balls	12@12¼c	
3-Ply " 1½ lb Balls	11@11¼c	
Cotton Wrapping, 5 Balls to lb	15@16c	

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 10@15
Howard.....dis 30
Maneer's machinist.....dis 50&10

Wire.

New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....$6.00@lb dis 30

Wrenches.

Coe's genuine, cash in ten days.....dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 10
William's " " .....dis 10
Alligator " " .....dis 40

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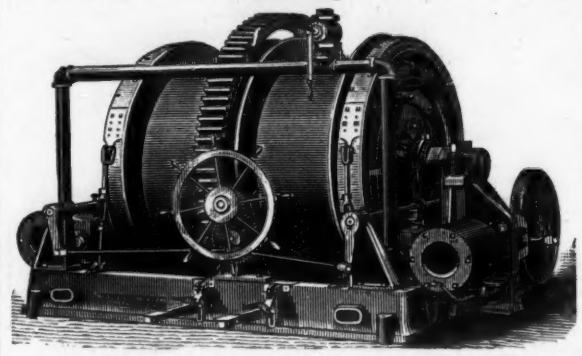

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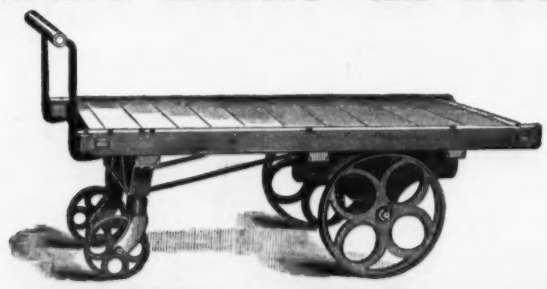

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Write for Catalogue of Iron, Steel and Wood Barrows and all styles of Trucks.

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ommon augers and bits.....dis 70
nell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ₩ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ₩ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $2 75@3 25
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....₩dox. $6 25@6 75
Others.....₩doz. $5 75@6 00
Full polished.....$8 25

Bolts.

Cast iron barrel bolts.....dis 70@70&10
Cast iron shutter bolts, etc.....dis 70@70&10
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70@70&10
Wrought iron square bolts.....dis 70@70&10
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 75&7½
Tire, common, new list.....dis 70
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 62½
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 80
Cast brass, loose joint.....dis 33⅓&10
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60&5
Fast joint, broad.....dis 55&10&5@60&10
Loose joint.....dis 70&10@75
Loose joint, jap.....dis 70&10@75
Loose joint, jap. with acorns.....dis 70&10@75
Loose pin, acorns.....dis 70&10@75
Loose pin, japanned acorns.....dis 70&10@75
Loose pin, acorns, jap. plated tips..dis 70&10@75
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10@75
Wrought, fast joint, broad.....dis 70&10@75
Wrought, loose joint, broad.....dis 70&10@75
Table Butts, back flaps, etc.....dis 70&10@75
Regular inside blind.....dis 70&10@75
Light inside blind.....dis 70&10@75
Loose pin.....dis 70&10@75
Light loose pin.....dis 70&10@75

Chains.

Trace, 6¼-10-2.....₩ pair 1.03
Trace, 6¼-10-3.....₩ pair .92 } 50&10@50&10&5
Trace, 7-10-2.....₩ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887..dis 50&10&5@60
Galvanized Pump Chain.....₩ lb5¼@6
Jack Chain, Iron.....dis 75@75&5
Jack Chain, Brass.....dis 70@70&5

Chisels.

Socket Framing and Firmer.....dis 75&5@75&10
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....₩ gross $12, dis 25@25&5

Hangers.

Barn door, old patterns.....dis 10&10@70
Climax, (Anti-Friction).....dis 70
Star.....dis 40&10@40&10&5
Scranton.....dis 40
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

	No. 10	9	8	7	6	
Ausable, ₩ lb.	23	24	25	26	28.	dis 25&10@25&10&10
Putnam, ₩ lb.	18	19	20	21	23.	dis 15
Essex						dis 25&10@25&10&10

Horse Shoes.

Burden, at factory.....₩ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....₩ keg $4 00
Mule Shoes, at factory.....₩ keg $5 00

Knobs.

Carriage, japanned.....₩ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbear, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60
Escutcheons and keys.....dis 60
Padlocks and padlock keys.....dis 66⅔
Bell pulls, mineral, porcelain and jet.....dis 60
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs. genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 66⅔
Letter box plates, genuine bronze...dis 60&10
Barn door locks.....dis 33⅓

Plumbs and Levels.

Standard list.....dis 70&10@70&10&10
Pocket levels.....dis 70&10@70&10&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@00
Pitcher spout, best makers.dis 60&10@60&10&10
Pitcher spout, cheaper goods dis 70&5@70&10&5

Pokes, Animal.

Bishop's I. X. L.....₩ doz $6 50
Bishop's O K.....₩ doz $5 50
Bishop's Pioneer.....₩ doz $3 75
Bishop's American.....₩ doz $3 00

Rakes.

Cast steel.....dis 65
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@[illegible]...dis 10
Rifle razor.....dis $9 50 net

Scales.

Hatch, Counter, No. 171.....₩ doz $21 00
Hatch, Tea, No. 161.....₩ dox $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....₩ doz $18 dis 25

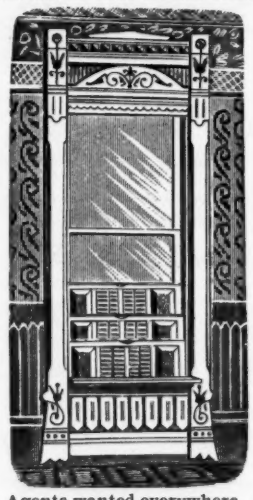
Squares.

Steel and iron } dis 75&10@80
Nickel plated }
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, January 2, 1888.
American iron carpet tacks all kinds.....dis 80@80&5
Steel carpet tacks all kinds.....dis 80@80&5
Swedes iron carpet tacks, all kinds.....dis 80@80&5
Swedes iron tacks.....dis 75&5@75&10
Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
Tinned Swedes iron tacks..dis 75&10@75&10&5
Tinned Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
American iron cut tacks.....dis 75@75&10
Copper tacks.....dis 50&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10@50&10&5
Finishing nails.....dis 70&10@70&10&10
Hungarian nails and miners' tacks.....dis 70&10@70&10&10
Gimp and lace tacks.....dis 75&10@75&10&5
" " " tinned.dis 75&10@75&10&5
Trunk and clout nails.....dis 70&10@70&10&10
Tinned trunk&clout nails.dis 70&10@70&10&10
Basket nails.....dis 70&10@70&10&10
Chair nails.....dis 70&10@70&10&10
Common and patent brads.dis 70&10@70&10&10
Tinned capped trunk n'ls..dis 70&10@70&10&10

Hartman's Patent Inside Sliding Window Blind



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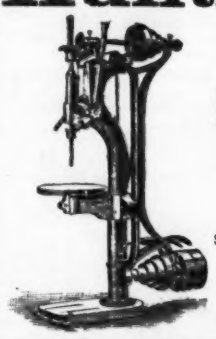

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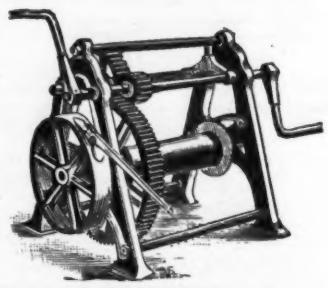

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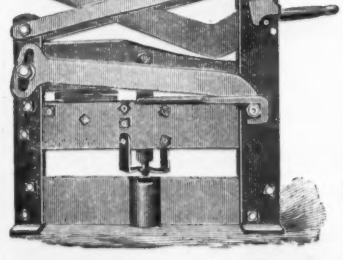

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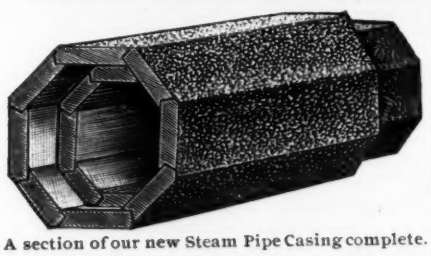

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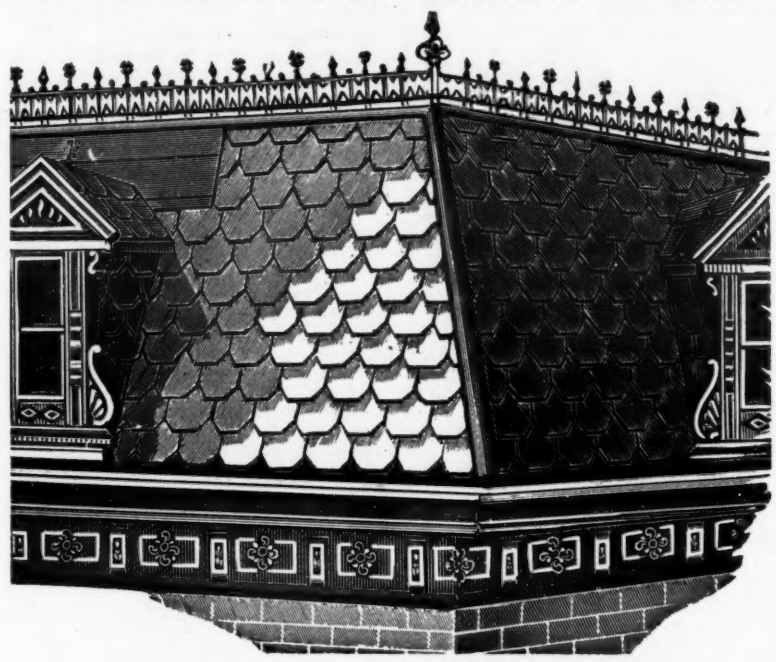

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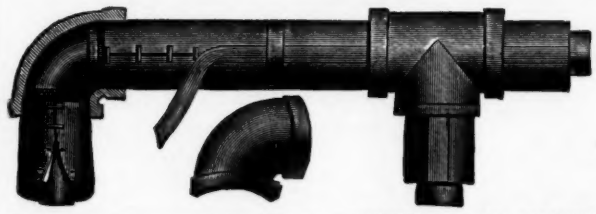

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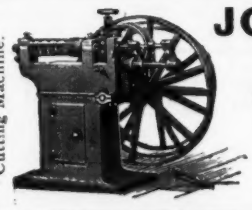

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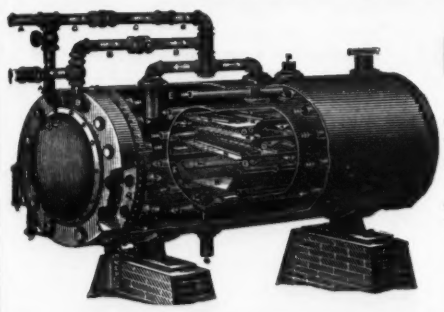

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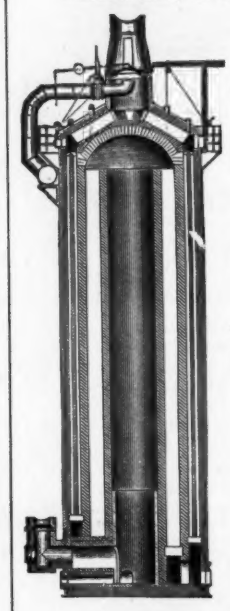

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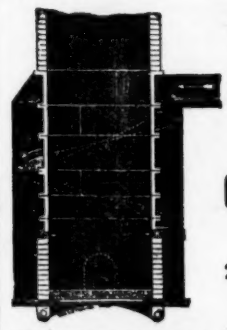

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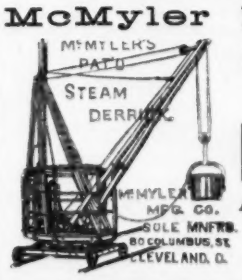

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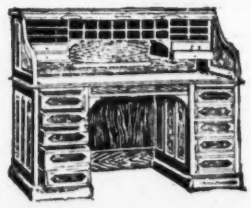

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Detroit Steamer	†5 00 a. m.	10 00 p. m.

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Standard Time.
Revised March 6th, 1888.

N. Y., C. & St. L. R. R. Co.—"The Nickel Plate."

Eastward.	Arrive.	Depart.
Buffalo Passenger	10 40 a m	10 45 a m
Chicago Passenger	9 20 p m	.....
Local Freight	4 30 p m	.....
Westward.	**Arrive.**	**Depart.**
Chicago Passenger	.....	6.30 a m
Fostoria Passenger	5 06 p m	5 11 p m
Local Freight	1 00 p m	.....

Rocky River Accommodation departs 7:40 a. m.; 1:40 p. m.

Euclid Accommodation departs 6:20 a. m.; 4.55 p. m.

All trains daily, except Sunday.

Cleveland & Pittsburgh.

	Arrive.	Depart.
New York Express	12 50 p m	8 00 a m
New York Express	6 35 p m	1 05 p m
Alliance & Akron Accom	9 40 a m	3 25 p m
Ravenna Accommodation	8 25 a m	5 00 p m
Night Express	*5 25 a m	*11 10 p m

*Daily; all other trains daily, except Sunday.

Mt. Vernon & Pan Handle Route.

C., A. & C. Ry. Co.	Arrive.	Depart.
Akron, Col. & Cin. "Flyer"	5 40 p m	8 10 a m
Akron, Col. & Cin. Night Express	7 00 a m	8 00 p m
Akron, Col. & Zanesv'e Ex	12 50 p m	1 05 p m
Akron & Orrville Accom	9 40 a m	3 25 p m

The 8 p. m. train runs daily. Elegant Pullman palace sleeping cars attached. All other trains daily, except Sunday.

Erie Railway.

Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo		†6 40 a m
Pittsburgh Express	†6 25 p m	
Youngstown Local	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom		†4 30 p m
Pittsburgh Express	†1 20 p m	11 10 p m
New York Express	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

(Standard Gauge.)

Depart for—

Zanesville and Coshocton—6:55 a. m., 3:05 p. m.
Canton—6:55 a. m., 3:05 p. m., 6:20 p. m.
Kent—6:55 a. m., *8:50 a m., 3:05 p. m., 6:20 p. m., *8:15 p. m.
Bedford—6:55 a. m., *8:50 a. m., 11:10 a. m., 1:30 p. m., 3:05 p. m., 5:45 p. m., 6:20 p. m., *8:15 p. m.
Newburgh—6:10 a. m., 6:55 a. m., *8:50 a. m., 11:10 a. m., 1.30 p. m., 3:05 p. m., 4:40 p. m., 5:45 p. m., 6:20 p. m., *8:15 p. m.
Canton and intermediate stations (Sundays only), 8:00 a. m., 4:20 p. m.

Arrive from—

Zanesville and Coshocton—10:25 a. m., 6:30 p. m.
Canton, 10:25 a. m., 2:35 p. m., 6:30 p. m.
Kent—*7:45 a. m., 10:25 a. m., 2:35 p. m., 6:30 p. m., *7:10 p. m.
Bedford—6:00 a. m., *7:45 a. m., 10:25 a. m., 1:05 p. m., 2:35 p.m., 4:15 p. m., 6:30 p.m., *7:10 p.m.
Newburgh—6:00 a. m., 7:10 a. m., *7:45 a. m., 10:25 a. m., 1.05 a. m., 2:35 p. m., 4:15 p. m., 5:35 p. m., 6:30 p. m., *7:10 p. m.
Canton and intermediate stations (Sundays only), 9:50 a. m., 6:10 p. m.
Trains marked * run daily.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA.

Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail	*7 40 a m	*6 20 p m
Marietta Express	†11 15 a m	†2 20 p m
Valley Junction Express	*4 15 p m	*10 15 a m
Cleve. and Canton Express	*7 00 p m	†8 10 a m

*Daily. †Daily, except Sunday.

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Cleveland, Lorain and Wheeling.

All trains arrive and leave the Union Depot as follows:

	Depart.	Arrive.
Wheeling Express	6 45 a m	6 55 p m
Uhrichsville Express	4 00 p m	9 20 a m

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	Depart.
No. 62, Accommodation	† 6 05 a m
No. 72, New York Express	* 8 10 a m
No. 72, Fast Pittsburgh Express	* 8 10 a m
No. 64, Fast Pittsburgh Express	* 3 00 p m
No. 66, Mantua Accommo	* 4 20 p m
No. 68, New York Vestibule Limited.	* 8 25 p m
No. 70, Pittsburgh Local Express	*11 25 a m
No. 74, Jamest'n, Pitts. & Y'ngst'n Ex	† 4 20 p m
	Arrive.
No. 65, Fast New York Express	*10 05 a m
No. 61, N. Y. & Pittsburgh Express	* 7 15 a m
No. 71, Youngstown Local	* 2 10 p m
No. 67, Pittsburgh Express	†12 30 p m
No. 63, New York Express	* 6 50 p m
No. 63, Pittsburgh Express	* 6 50 p m
No. 69, Pittsburgh Local Express	† 8 55 p m
No. 73, Mantua Accommo	* 7 20 p m

*Daily. †Daily, except Sunday.

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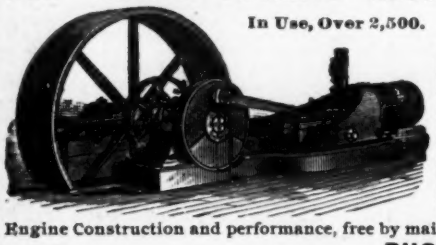

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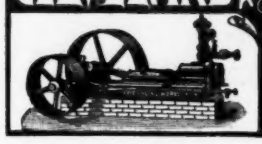

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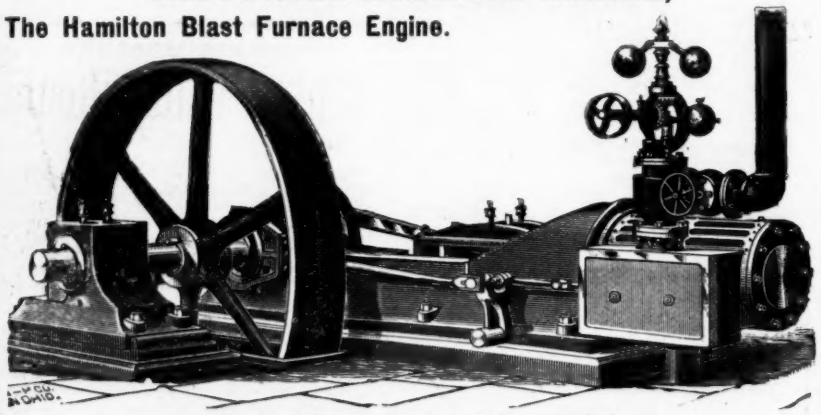

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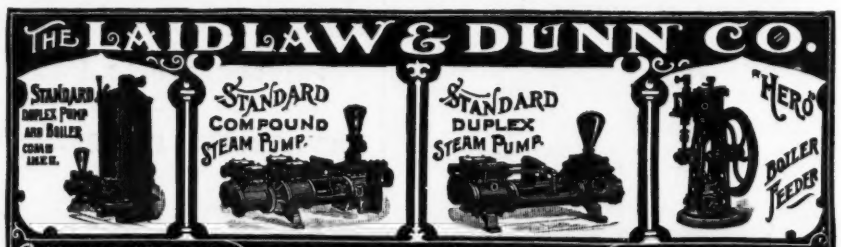
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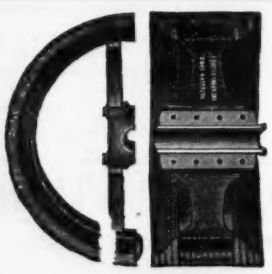

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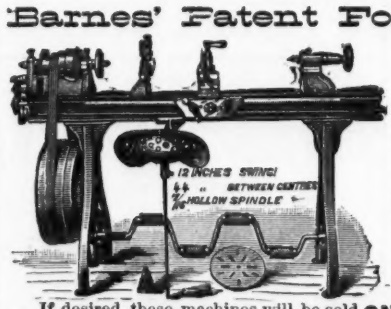

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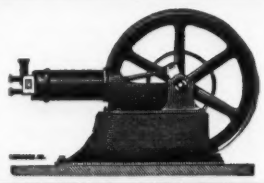

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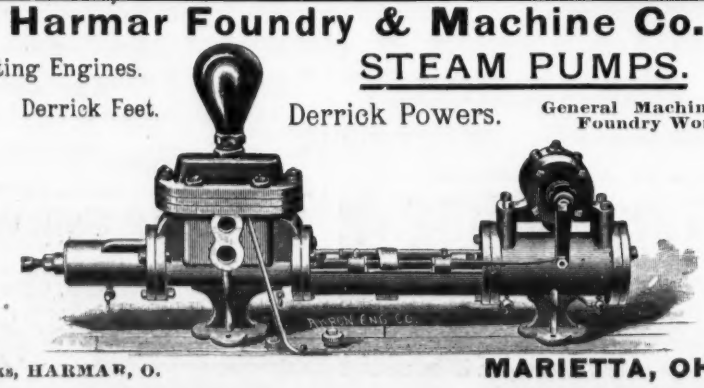

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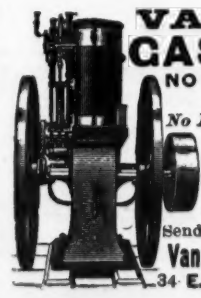

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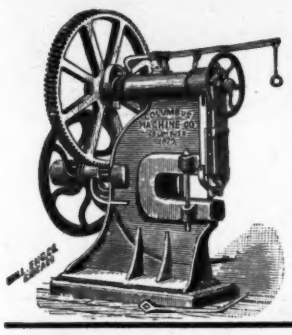

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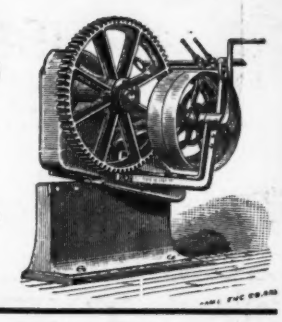

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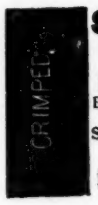

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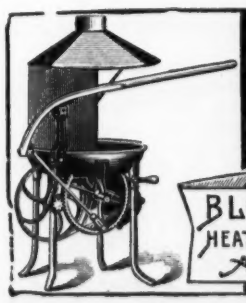

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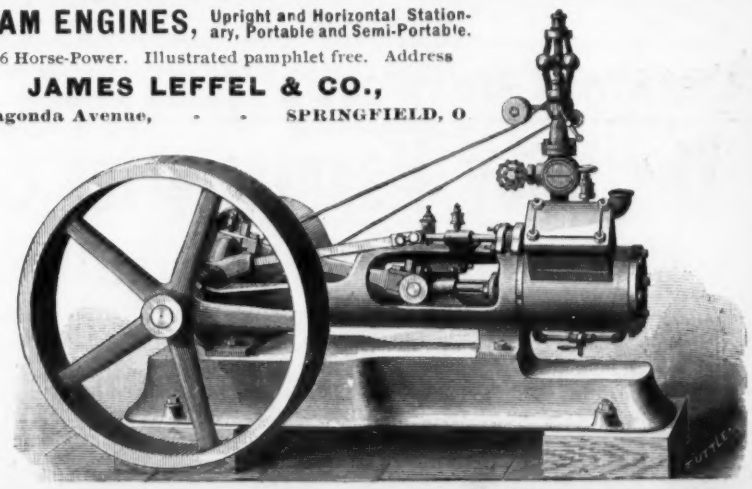

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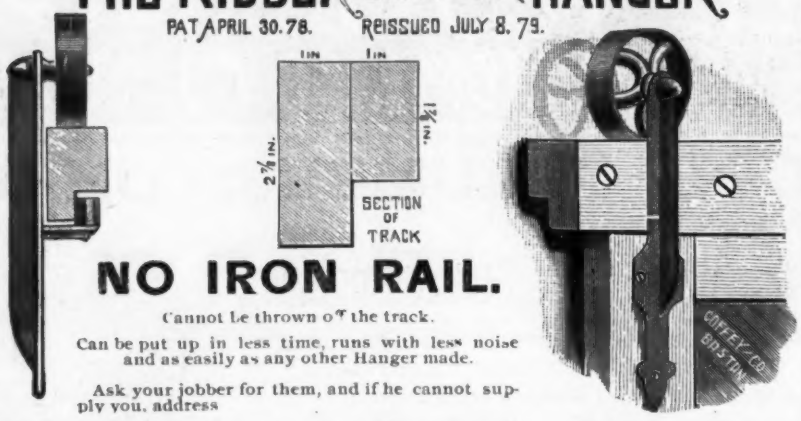

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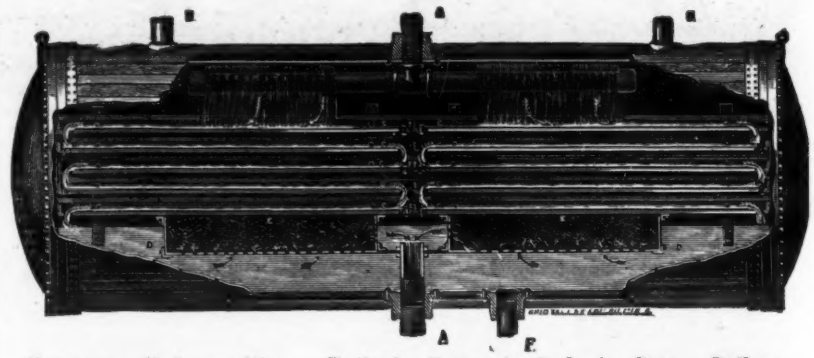

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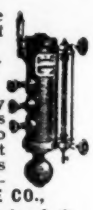

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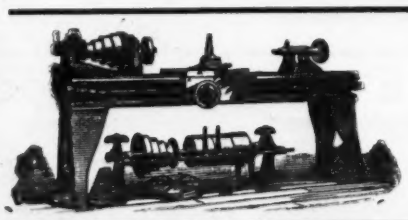

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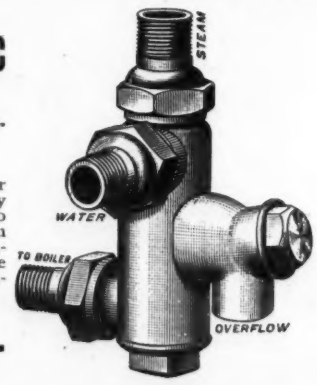

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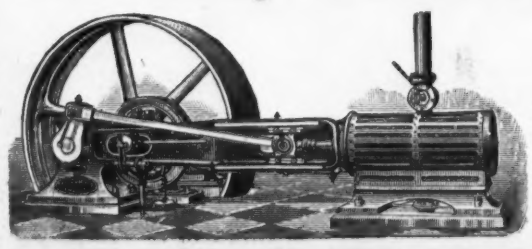

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